Digitized by the Internet Archive
in 2010 with funding from
University of Toronto

http://www.archive.org/details/journalfranklini21fran

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania:

AND

MECHANICS' REGISTER.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

BY THOMAS P. JONES, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, THE AMERICAN ACADEMY OF ARTS AND SCIENCES, MASSACHUSETTS, AND CORRESPONDING MEMBER OF THE POLYTECHNIC SOCIETY OF PARIS.

NEW SERIES.

VOL. XVII.

VOL. 21.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL;
THOMSON & HOMANS, WASHINGTON CITY; E. I. COALE & CO.
BALTIMORE; G. & C. CARVILL & CO., NEW YORK; AND
MONROE & FRANCIS, BOSTON.

1836

621050
20.10.55

T
1
F8
v.21

JOURNAL

OF THE

FRANKLIN INSTITUTE

Of the State of Pennsylvania,

AND

MECHANICS REGISTER;

DEVOTED TO

Mechanical & Physical Science, the Arts & Manufactures,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JANUARY, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

The Committee of the Franklin Institute on the Explosions of Steam-Boilers, respectfully present to the Secretary of the Treasury, their report of the experiments undertaken at the request of the department. The queries which were submitted by the committee, to the officer at whose request the experiments were instituted,* have formed the basis of the labours of the committee. They have, however, availed themselves of the privilege accorded, of trying such other experiments as might grow out of the investigation, or as they might deem of special interest.

The object of the experiments was to test the truth or falsity of the various causes assigned for the explosions of steam-boilers, with a view to the remedies either proposed, or which may be consequent upon the result of the investigation. The causes being accurately known, the attention of ingenious men is led away from false suppositions, which can only waste their time and talent, if taken as the basis of their plans for safety; greater hope is afforded of an efficient remedy; applications of an indirect, or it may be of a positively injurious sort, are avoided; and if the causes be found to be such as for the present, to baffle ingenuity in their removal, the attention is directed more fixedly towards the means of protection against the effects of such accidents. The committee hope that the results of their inquiries will not be found without fruit.

It was the aim of the committee to provide for the experiments an apparatus of such dimensions as to furnish results applicable to practice, without being so great as to be managed with difficulty, or to increase, unnecessarily, the danger incident to parts of the investigation. To arrange the apparatus and complete the details, they secured the services of an able and experienced mechanic, David H. Mason, by whom, or under whose direction, the nicer parts of the work were executed, and who assisted, also, in the experiments.

---

* The Hon. S. D. Ingham, late Secretary of the Treasury of the United States.

The committee propose first to give a general description of the apparatus used, followed by details in the more complex parts; next to report the results of their examination upon each of the questions proposed for investigation.

GENERAL DESCRIPTION OF THE APPARATUS.

The boiler used by the committee, and represented in Plates 1, 2, and 3, was twelve inches in interior diameter, two feet ten and a quarter inches in length within, and one-fourth of an inch thick; of rolled iron, with the heads rivetted in the usual manner. Plate 1 is a side view, and 2 and 3 are end views of the boiler, and of the apparatus connected therewith. The boiler was placed horizontally in a furnace, the fire surface extending about half way round the cylinder.

The furnace was arranged for a charcoal fire, the grate bars extending the whole length of the boiler, and the fire being applied through nearly the whole length. The draught entered by an opening, closed in the usual manner, and left the furnace through a flue placed at one end and side of the boiler. It will be convenient to use the terms fire end or front of the boiler, in reference to the proximity to the furnace door, and back end of the boiler. In Plate 2, A is the ash-pit door, B the furnace door, and in 1 and 3, C is the furnace chimney.

In order to examine, readily, the interior of the boiler during the progress of the experiments, each head was provided with a glass window, (D, Plates 2 and 3.) The glass used was three-eighths of an inch thick. The openings in the ends, which were rectangular, were two and a half by one and three-quarter inches wide. At first a glass plate, rather larger than the rectangle just mentioned, was applied to the opening, and kept in its place by four strips of brass secured to the heads, on which a rectangular frame, having the surface next to the glass accurately ground, was secured; the pressure of the steam keeping the glass against this frame, closed the boiler. Fractures occurring frequently from the rapidly varying, and often considerable, pressures within the boiler, and taking place by pressing the middle part outwards, as was proved by examining the fractures, frames with cross bars, see Plates 2 and 3, having the interior surface carefully ground, were used. The difficulty of properly adapting the surface of these frames to the glass having been removed, they were used in the later experiments, and were found to afford a sufficiently good view of the interior of the boiler, notwithstanding the obstruction by the cross bars.

Three gauge cocks were placed in the front head of the boiler; their positions will be particularly stated hereafter; they are shown in Plates 1 and 2, at *a*, *b*, and *c*.

To the same head and by the side of the gauge cocks, a glass water gauge (*w*, *x*, Plates 1 and 2) was attached, a particular description of which will be given in the detail of experiments made to compare its performance with that of the gauge cocks.

To supply the boiler with water, a forcing pump E E′ F G, Plates 1 and 3, was placed near the back end. This pump was of the ordinary construction, with a solid plunger and conical valves; the diameter of the pump was one inch, and the play of the piston one inch and three-quarters. The diameter of the pipe, F G, by which the water was conveyed from the pump to the boiler, was three hundredths of an inch. By a coupling screw, this pipe could be connected with either of the stop cocks, *d*, *e*, Plate 3, in the back end of the boiler: the opening of these cocks was two hundredths of an inch in diameter.

To ascertain the elasticity of the steam within the boiler, a closed steam gauge (H, Plates 1 and 3) was used, a particular description of the construction, &c. of which will be given. This instrument was placed upon the same stand (I, Plates 1 and 3) which supported the pump, so that the same experimenter could observe its indications and attend to the working of the pump. The cistern of the gauge was connected by a flexible pipe, *f*, *g*, with the upper part of the boiler.

The safety valve is shown on the top of the boiler, (K, Plate 1,) midway between the heads. The graduation of it required much pains, and will receive a separate discussion.

Near the safety valve is represented at L, Plates 1 and 3, the fusible plate apparatus, consisting of a sliding plate of iron, moved by a lever. On the other side of the safety valve are the thermometers, M and N, Plate 1, plunged into iron tubes to give the temperature of the steam and water within the boiler. Above this appears the reservoir, O, containing the water intended to maintain the scales of the thermometers at a constant temperature. All these parts require a more detailed description.

DETAILS OF THE APPARATUS.

Of the Steam Gauge.

The steam gauge consisted of a glass tube closed at the upper, and open at the lower end, which passed steam-tight into a reservoir for mercury: when this reservoir was connected wth the boiler the pressure of the steam raised the mercury into the gauge tube, compressing the air which the tube contained. The first mercurial gauge which was made was broken by a sudden access of surcharged steam, in the experiments upon that subject, and was replaced by a second one. The method of graduation, and in general the description of the second gauge, will serve also for the first; the details, only, varied slightly.

The glass gauge tube was 26.43 inches in length. To the lower end was connected an iron ferule, terminated above by a projecting ring. This ring was pressed upon the upper end of the pipe, *h*, Plate 1, by a coupling screw, which served to form a tight juncture between the gauge and the cistern. The cistern *i* was a cylindrical vessel of cast iron, having the two projecting tubes *h* and *k* upon which screws were cut; the first of them has been alluded to as giving a passage to the glass tube of the gauge; the second was coupled by the pipe *f g*, Plates 1 and 3, to the boiler.

The gauge tube was not of precisely equal diameter throughout, and it was judged more accurate to graduate small portions of it into equal volumes. This was done by introducing equal measures of air from the point of a sliding-rod gas measure (Hare's); this operation was performed repeatedly, and by multiple measures to verify the results, until the marks made for the equal volumes, on a paper scale attached to the tube, coincided, in the various trials. The lengths of the spaces occupied by the equal volumes were then carefully measured upon the brass scale to be used with the gauge. The slight differences between the lengths given by adjacent parts of the tube, showed that it might be considered as divided into so many small portions of uniform diameter. The mercury rising into the gauge tube from the cistern when pressure is applied, the level of the cistern is necessarily depressed; the amount of the correction for this depends upon the relation between the areas of the cistern and tube, supposed uniform. The areas of the cistern were found to be, within the limits of its use, sensibly the same; those of the tube might be so assumed for such a purpose: the ratio was therefore found by filling the gauge tube with mercury, and pouring this into the cistern, noting the rise produced; comparing this with the mean length of the tube, the ratio of depression in the gauge for elevation in the tube was found to be as .01 to 1. The air within the tube was next carefully dried by the introduction of a receptacle of chloride of calcium, of the same length with the tube;* the air having been in contact with this substance for a sufficient time, the receptacle was withdrawn through the mercury over which the drying had been effected; the tube was next placed over a dish of mercury, in the receiver of an air pump, and the air withdrawn until on re-admitting air to the receiver, the mercury rose in the tube above the iron ferule.

The gauge tube was next introduced into the cistern, the level of which corresponding to the zero of the brass scale was then arranged, and the point of the scale at which the mercury stood was ascertained, the barometer and thermometer being noted.

It was intended in the experiments to keep the pipe from the gauge to the boiler cool, so that it might contain water, and thus give a nearly constant pressure upon the mercury of the cistern,† besides preventing the exposure of the apparatus to heat; the height of this column, above the level of the cistern, was therefore ascertained, after the gauge was put in place by screwing the cistern *i* to the stand.

All the elements for calculating the elasticity of the steam within the boiler, from the height of the mercury of the gauge, were thus known; the temperature of the apparatus being supposed constant.

The elastic force of the steam within the boiler, together with the column of water in the steam pipe, balances the elasticity of the compressed air within the gauge, together with the column of mercury above the level of that in the cistern. This level is not the original zero, but lower than that by the depression produced by the rise of mercury in the gauge tube. The depression of the mercury changes the level above which the pressure of the column of water in the steam-pipe, is measured, but the change in the pressure, by the column of water, is altogether inconsiderable. The law of the elastic force of dry air, which has been recently shown, by Dulong and Arago, to be accurate, at pressures from one to fifty atmospheres, was made use of in determining the elasticity of the air in the gauge: this elasticity is inversely as the space occupied by the air. From the data already obtained and upon the principles just stated, a table was calculated by which the observed heights of the gauge were converted into the corresponding pressures in inches of mercury or in atmospheres. The calculations were rendered rather tedious by the unequal diameter of the bore of the tube, on account of which equal lengths did not correspond to equal volumes. The usual method of calculation was resorted to, namely, to determine, by rigid calculation, the pressures, for points sufficiently near each other, and then to interpolate for intermediate heights.

The foregoing remarks take for granted that the temperature of the air in the gauge, as well as that of the mercury, remains constant; to secure this, an arrangement was adopted similar to that employed by Dulong and Arago for the same purpose. The gauge and scale were surrounded by a glass tube, *l*, Plates 1 and 3, cemented below into a brass cap, *m*, Plate 1, which had an opening in the side, communicating with a discharge pipe, *n*, Plates 1 and 3. The tube was attached above by an air-tight juncture to a tin vessel, P, of considerable capacity, compared with the tube. Water being introduced into the glass tube surrounding the gauge, the flow through this tube was regulated by a stop-cock, *o*, placed at the end of the discharge pipe, the cistern above being filled with water.

---

* By this method, each volume of air in the tube was in contact with nearly a twelfth of its bulk of the chloride.

† This and very many of the other precautions to insure accuracy, are borrowed from the able memoir of Dulong and Arago on the elastic force of steam at different temperatures; the result of their labours, as members of a Committee of the French Academy. Those who have engaged in questions of research will know that too great care cannot be taken to prevent the introduction of error, even in researches where great nicety may not be considered essential.

To ascertain the temperature of the column of water surrounding the gauge, a thermometer, *p*, Plate 3, with a very small bulb was attached to the scale at the middle of its height: by this instrument, the flow of water through the casing of the gauge was regulated so as to keep the temperature nearly constant, and any deviations from a constant temperature were ascertained and noted, that the proper correction might be applied. The correction for the expansion of the air in the gauge, by a rise in its temperature during the progress of the experiments, was made according to the rules furnished by the rate of expansion of the gases, as determined by Gay Lussac, extended to compressed air by the experiments of Davy.* The correction for the changes of height of the mercurial column, within the range to which the temperature was suffered to increase, could not have been appreciable if acting entirely, and the counteracting effect of the expansion of the glass, further justified its being neglected. For similar reasons no reference was made to the effects of heat on the mercury in the cistern, *i*, on the cistern itself, and on the water within the pipe communicating with the boiler.

On the Thermometers.

In most of the researches of the committee, refinements in the mode of using the common thermometer would have been out of place. Results which might be obtained with little additional labour, and which would be interesting in both a practical and scientific point of view, were not to be neglected, and

---

* Let e represent the elastic force of the air within the gauge tube, expressed in inches of mercury; let h be the height of the mercurial column above the original zero; h', the height of the column above the new level; a, the height of the column of water in the steam pipe above the zero; s, the specific gravity of mercury; t, the tension of the steam within the boiler, in inches of mercury. Then $h'-h$ is the depression in the cistern caused by the rise of mercury in the gauge, and $a+h'-h$, the height of the column of water in the steam pipe above the new level in the cistern. We have then,

$$e+h+h'-h-\frac{a+h'-h}{s}=t$$

For the gauge in question, $h'-h=.01\,h$, $a=17.5$ inches, also $s=13.6$; then

$$e+1.01\,h-\frac{17.5}{13.6}-\frac{.01\,h}{13.6}=t, \text{ or } e+1.01\,h-1.29-.0007\,h=t;$$

the term $.0007\,h$ may be neglected as inconsiderable, since for $h=24$ inches, this term is only .0163. The equation then stands,

$$e+1.01\,h-1.29=t.$$

At the temperature of 48°, and at a mean pressure, the observed value of h was 3.23; of course, $e=26.77$. The volume of the air in the gauge was 8.63.

To find the elasticity for any other height, h', find from the data relating to the volume of the air in the gauge, the new volume; call this v', and the elasticity due to it e'; then:—

$$v:8.63::26.77:e'; \text{ and}$$
$$e'+1.01\,h'-1.29=t.$$

To introduce the correction for temperature, since the elasticity produced by an increase of temperature corresponds with the expansion produced, and since the expansion of condensed air follows the same law as that of air of ordinary density, expanding $\frac{1}{480}$th of its bulk at 32°, for each additional degree of Fahr. above this point, or $\frac{1}{496}$th of its bulk at 48°; calling e'' the elastic force of the heated air, e' that of the same air at 48°, n being the number of degrees of heat above 48°.

$$e''=e'+\frac{n\,e''}{496}=e'\,(1+.002\,n)$$

whence, since $e'=\dfrac{8.63\times 26.77}{v'}$,

$$\frac{231.02}{v'}.(1+.002\,n)+1.01\,h'-1.29=t.$$

to some of them great accuracy was essential. In the questions of the first class the thermometers were provided with wooden scales, and were graduated by immersion up to the point at which the scale commenced, the scale and upper part of the tube being exposed to the air; this was proper, as they were intended to be immersed in mercury nearly up to the scale. These instruments were examined after coming from the makers' hands, and the instrumental error ascertained. The tubes in which the thermometers were placed, and which contained mercury, were at first placed horizontally in one of the heads of the boiler; this had the advantage of rendering the tube for indicating the temperature of the water entirely independent of the steam, and thus any difference between the temperature of one and the other might be more effectually ascertained, than when the tube giving the temperature of the water passed through the steam. The position of these instruments interfered so much with other parts of the apparatus, and so much inconvenience and danger of error was experienced from the separation of the column of mercury in the thermometer, that these tubes were not used after the first weeks of experiment, and two vertical tubes, placed as already shown, were substituted for them.

The thermometers used, when the relation between the temperature of the steam and water, and the elasticity of the steam were to be observed in conjunction with some of the subjects more directly under the cognizance of the committee, had much pains bestowed upon them.

The scales (M and N, Plate 1,*) were metallic, and surrounded by glass tubes, fitting into a cup, *a'*, through the bottom of which the stem of the thermometer passed water tight; a pipe, *b' c'*, Plate 2, from the side of each cup, and provided with a stop-cock, *d'*, regulated the flow of water through the enveloping tubes: a tight connexion above, with a reservoir, (O, Plates 1 and 3,) served, as in the case of the gauge, to supply the tubes with water. Small thermometers on the back of the scale of the large ones, showed the temperature of the water which surrounded them. The enveloping tubes being filled with water at 60°, the position of the boiling point of water and of the fusing point of tin, were used to verify the accuracy of graduation. The latter point, which is high upon the scale of the thermometer, having been very accurately determined, and being easily and with certainty ascertainable, serves as an excellent check upon the graduation. The greatest error within the limits just stated, was, in one instrument, three-fourths of a degree, and in the other one degree of Fahrenheit. The scales were graduated from two to two degrees, one quarter of a degree being readily estimated upon them. The corrections required by this examination were made through the medium of a table prepared for the purpose. In order to call the attention to the temperature of the water surrounding the scales, this temperature was recorded from time to time, when the height of the thermometers was observed. At no time did the rise of temperature, permitted in the water, make it necessary to apply a correction for the expansion of the scale.† None was required for the cooling effect of the water around the stem upon the mercury, owing to the method of verifying the scale.

The other parts of the apparatus, less general in their use, as the water gauge, safety valve, fusible plate apparatus, &c., will be more conveniently described in connexion with the experiments for which they were devised.

---

* In Plate 2, thermometer N, to render it conspicuous, is shown, as if the scale were turned to the front of the boiler.

† Upon the scale of one of these instruments there were 314° in 6 inches. Brass expands $\frac{1}{532}$ds of its length, from 32° to 212°. These 6 inches, at 32°, would become 6.0113 at 212°. Ten degrees upon the scale would become 9.99 by a variation of temperature from 32 to 212°, a diminution of only .01 of a degree for a variation of 180° in the temperature of the scale. In practice, the variation never exceeded thirty degrees.

SUBJECTS OF INVESTIGATION.

The queries originally proposed, together with the new matters, which were made the subjects of experiment, will be treated in the following order.

I. To ascertain whether, on relieving water heated to, or above, the boiling point from pressure, any commotion is produced in the fluid.

Including the examination of the efficacy of the common gauge-cocks, of the glass gauge, and of Ewbank's proposed gauge-cocks.

The investigation of the question whether the elasticity of steam within a boiler may be increased by the projection of foam upon the heated sides, more than it is diminished by the opening made.

II. To repeat the experiments of Klaproth on the conversion of water into steam by highly heated metal, and to make others, calculated to show whether, under any circumstances, intensely heated metal can produce, suddenly, great quantities of highly elastic steam.

First, The direct experiment in relation to the production of highly elastic steam in a boiler heated to a high temperature.

Not to interrupt the general train of investigation which follows a well known theory of explosions of steam boilers, the results of the experiments on the former part of this query, are inserted in another place.

III. To ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour.

IV. When steam, surcharged with heat is produced in a boiler, and is in contact with water, does it remain surcharged, or change its density and temperature?

V. To test, by experiment, the efficacy of plates, &c., of fusible metal, as a means of preventing the undue heating of a boiler, or its contents.

1. Ordinary fusible plates and plugs.
2. Fusible metal, inclosed in tubes.
3. Tables of the fusing points of certain alloys.

VI. To repeat the experiments of Klaproth, &c.

1. Temperature of maximum vaporization for copper and iron under different circumstances.
2. The extension to practice, by the introduction of different quantities of water, under different circumstances of the metals.

VII. To determine, by actual experiment, whether any permanently elastic fluids are produced within a boiler when the metal becomes intensely heated.

VIII. To observe accurately the sort of bursting produced by a gradual increase of pressure, within cylinders of iron and copper.

IX. To repeat Perkins' experiment, and ascertain whether the repulsion stated by him to exist between the particles of intensely heated iron and steam be general, and to measure, if possible, the extent of this repulsion, with a view to determine the influence it may have on safety valves.

X. To ascertain whether cases may really occur when the safety valve, loaded with a certain weight, remains stationary, while the confined steam acquires a higher elastic force than that which would, from calculation, appear necessary to overcome the weight on the valve.

XI. To ascertain by experiment the effect of deposits in boilers.

XII. Investigation of the relation of the temperature and pressure of steam, at ordinary working pressures.

Table from 1 to 10 atmospheres.

I. To ascertain, by direct experimemt, whether on relieving water heated to, or above, the boiling point, from pressure, any commotion is produced in the fluid.

The first experiments on the effect of relieving water in ebullition from pressure, were made in a glass boiler; here the fire was under the whole length of the boiler, which was a cylinder of fourteen and a quarter inches in length, and seven and a half inches in diameter. The steam within, being at a pressure of less than two atmospheres, by opening a cock at the end of the boiler, or the safety valve, also at the end, large bubbles were formed through the whole extent of the boiler.

The inquiry was prosecuted in the iron boiler already described, a distinct view of the interior being had through the glass windows placed in the heads. The greatest intensity of the fire was in front of the middle of the boiler, and extended through about one-third of its length: the part immediately near the flue, was next to this band in temperature. With this boiler experiments were made, which showed, that on making an opening in the boiler, even when the pressure did not exceed two atmospheres, a local foaming commenced at the point of escape, followed soon by a general foaming throughout the boiler, the more violent in proportion as the opening was increased. This small boiler was completely filled with foam by opening the safety valve, (nearly two-tenths of an inch in area) which was placed on the middle of the top, and the water violently discharged through the opening of the valve. The area of the valve bears to the horizontal section of the boiler, at the water line, the ratio of one to two thousand and fifty-five nearly.

The boiler was half full of water in these experiments. The gauge fell always on making the opening.

The foaming, which was so repeatedly observed, must be produced in a greater or less degree every time that steam is drawn from a boiler to supply the engine; every time that a gauge-cock is opened, or the safety valve raised. It is interesting in two points of view; first, in its effects upon the apparatus designed to show the level of the water within the boiler; second, by its throwing the water against the heated sides of the boiler.

Gauge-cocks and Glass Water-gauge.

The apparatus most commonly used in our country for determining the level of the water within a boiler, consists of three gauge-cocks attached to the boiler head, one of them being at the water level, and the others equally distant above and below that level.

These cocks in the experimental boiler, *a*, *b*, *c*, Plates 1 and 2, were 1.95 inches and 1.8 inches apart, measuring from the centre of the opening of the middle one, to the one above and to the one below.

The steam in the boiler being not higher than two atmospheres, the following experiment was made. The level of the water was reduced until it stood just below the lowest gauge-cock. On opening this cock, steam at first flowed out, then water and steam; on opening the second cock, in addition, water flowed freely from the lowest, which was above the hydrostatic level; the foaming within the boiler, which was produced by thus relieving the pressure, was distinctly seen through the glass windows. On opening the third cock, steam and water issued from the second, which was two inches above the water level; and on partially raising the safety valve, water flowed freely from the second cock. A further rise of the valve filled the boiler with foam, water flowed freely out of the third cock, more than three inches and three-quarters above the water level, and finally through the opening of the safety valve itself. In these experiments, an opening of .03 of a square inch in area, the lowest cock, which, to the area of the water surface, was as one to thirteen thousand seven hundred, caused water and steam to issue through a cock, below which the water was known to be. A further opening of .03 of a square inch, making, with the first, .06 inch, or one six thousand eight hundred and fiftieth the area of the water surface, brought water from the lowest cock; a total opening of .09 inch, ($\frac{1}{4567}$th of the area of the water surface) brought water and steam from the middle cock, indicating that the level of the water was nearly two inches higher than it really was.

A first apparatus, which was contrived for applying fusible plates to the boiler, suddenly opened an aperture of .95ths of an inch in diameter. Even at low pressures, the scalding contents of the boiler were violently discharged, through this opening, against the roof of the experiment house.

It is time now to speak of the glass gauge-tube, as a means of indicating the level of the water within a boiler, in connexion with which an experiment bearing upon the performance of the gauge-cocks will be stated.

The form given to the water gauge, on its first trials, was that described to the committee by Mr. Hartshorne, of Cincinnati. This was a prismatic box of brass, of suitable dimensions; one face of which was supplied by a glass plate; this box, being put in communication with the boiler, by two pipes, one entering from the steam, the other from the water, the level of the water was seen through the glass plate. This apparatus was attached to the experimental boiler, and its indications compared with those of the gauge-cocks in the experiments already detailed. On relieving the water from pressure, the water within the gauge was agitated; during the further foaming its oscillations did not amount to half an inch, so that the hydrostatic level was truly shown by it; and further, on closing the openings, the fluid in the gauge became tranquil at the mean level of its oscillations, showing that it had fallen with the fall of the water within, caused by the escape of steam. An instructive experiment to the same purport was made on the occasion of a fracture in one of the glass windows, described as placed in the ends of the boiler. The account taken from the minutes of the day's experiments is as follows:

The temperature being at 292° F., and the pressure indicated by the gauge four atmospheres, the north window of the boiler, which had a flaw in it, cracked across the middle, and nearly horizontally; steam issued slowly through the crack; on looking into the boiler a foaming at the end where the steam was escaping was observed. The crack rapidly enlarging, the steam issued in quantities through it; the water was in general agitation throughout the boiler, running out at the crack, though its hydrostatic level was at the bottom of the window, about one inch and a quarter below the crack, and being distinctly seen at the opposite window, foaming near the top of the glass; the water-level gauge began to fall, oscillating not half an inch in its fall. The safety valve was now opened by hand, so as to waste the water with great rapidity. The water still issued through the crack, the water-level gauge falling. On closing the valve the water settled down, becoming comparatively tranquil; the water gauge remained at the same level: it had, therefore, indicated constantly the true level unaffected by the foaming, except in slight oscillations.

In fact, this gauge shows truly the height of the water within the boiler, until the foam rises so high as to pour over through the upper connecting tube.

The idea was suggested that by placing the gauge-cocks in a prism, connected above with the steam, and below with the water in the boiler, the true level of the water would be indicated. Such a cock was, therefore, applied to the box of the water gauge; its opening produced a local foaming in the gauge, which brought water through the cock, although the true level was much below it. The area of this cock was nearly equal to the area of that which opened into the steam chamber of the boiler.

In relation to the form of the water gauge, as already described, it does not seem to offer as many advantages as the tube which has been adapted to the boilers of some of the English locomotive engines.* The glass plate requires the support of horizontal bars, which are objectionable, or it must be reduced so much in breadth that the level is obscurely seen through it; the strain upon the plate being unequal, it is very liable to fracture; such fractures repeatedly took place near the centre of the plates in the gauge used by the committee.

To the use of the glass gauge for the high pressure engine, an objection occurs, from the effect produced by high steam upon the glass, apparently by its action on the alkali; by which the transparency of the glass is gradually destroyed. A similar effect was recorded by Cagniard de Latour, in his experiments on liquids at high temperatures, confined in glass tubes.† As far as the experiments of the committee have gone they show that green glass is not so readily injured; and as it is easily procured in tubes, a further reason appears for preferring the tube, in practice, to the plate.

An attempt which was made to substitute windows of mica in the boiler for those of glass, bears upon the use of that mineral for the plate of the water gauge; as does also another attempt which was made to protect the glass plates by a lamina of that mineral. The mica exfoliated under the action of the steam which insinuated itself between the laminæ through cracks which were invisible, if existing, before the experiment, or which may have been produced by the steam itself; the laminæ were separated, and thus the steam quickly found a more or less direct passage through the plate.

The tube gauge which was substituted for the prism is shown in Plates 1 and 2. $w\ x$ is the tube of green glass passing into the stuffing boxes, w' and x'; the stuffing enables an adjustment to be made for the unequal expansion of the glass and metal by heat, and prevents fracture on the subsequent cooling of the apparatus. y and z, Plate 1, are passages connecting the tube with the boiler; these have conical terminations, by which the pipe is readily attached to, and detached from, the tubes y and z, which are screwed into the boiler, and are provided with stop-cocks: coupling screws might, in practice, be substituted for these conical terminations. To protect the tube, $w\ x$, from currents of air, it was surrounded by a second tube, loosely applied. A scale was attached to $w\ x$, to indicate the level of the water within the boiler. The tube being transparent, shows the level of the water more readily than it can be seen in the prism before referred to, which was opaque on three of the vertical sides.

The gauge used was nine inches and three-quarters in length. The upper part being so near the top of the boiler as only to be affected by the foaming, in extreme cases; the lower part so near to the bottom that the level of the water was indicated, unless when very low indeed.

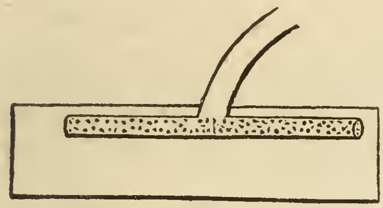
The position of the lower communication of the gauge with the boiler soon showed a defect, to which the instrument must be always more or less liable, namely, to the obstruction of the lower passage by sediment. To remedy this, a stop-cock was attached to the lower part of the gauge, as at x', Plate 1, and through it, when open, water could be blown, by the pressure of the steam in the boiler, so as to remove any obstruction. This method is to be preferred to that of closing the upper communication with the boiler, while the lower one remains open; in which case the sediment is driven up into the glass tube, soiling it, accumulating there, and affording only a temporary remedy. When the obstruction in the pipe is not removed on opening the cock, a wire inserted will effectually clear the passage.

---

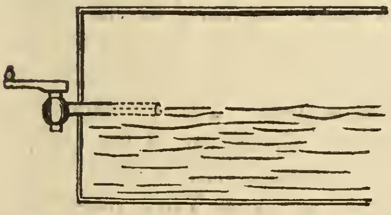
* The application of such a gauge to a locomotive engine can give but little idea of its use for a stationary engine. The jarring in the locomotive must constantly expose the gauge to fracture, and perhaps may prevent its use. The glass water gauge has been adopted in at least one of the boats plying between New York and Amboy, New Jersey, belonging to Messrs. Stevens; and the committee understands, are also in use upon their locomotive engines.

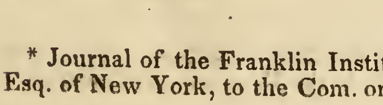
† See also recent experiments on the action of water at high temperatures upon glass, by Professor Turner, of the University of London. Royal Society's Trans. for 1834.

In connexion with this subject the committee experimented upon the method proposed by Mr. Thomas Ewbank, of New York, for lessening or preventing the foaming here stated to occur. The remarks of Mr. Ewbank are to the following effect: "When steam is raised in a boiler, and the engine not work-"ing, the water within (if the flues are sufficiently covered) is probably on a "level and nearly at rest; but as soon as the steam is admitted into the cylinder, "it causes an ebullition of the water, which rises towards the mouth of the "steam pipe, in consequence of the portion of the pressure upon it being *suddenly* "removed at every stroke of the piston. This might, I think, be prevented by "continuing the steam pipe an inch or two into the boiler, and then branching "it off towards each end of it, with small apertures in its sides and ends, as in "the diagram. In this manner, the steam "would be equally withdrawn from every "part of a boiler, instead of being violently "agitated in rushing to one place. Such a "tube attached to the aperture of a *safety-* "*valve*, would be equally advantageous; or the "valve might be placed on one end of the "tube leading to the cylinder.*



"The inaccuracy of the common gauge-cock as a means of detecting the "true height of the water in a boiler, arises chiefly from two causes; firstly, "from the agitation of the water while steam is being withdrawn from the "boiler to supply the engine, or through the safety valve: and secondly, from "the current or rush of steam produced towards the aperture of a gauge-cock "when it is open; in consequence of which the water, though previously at "rest, is agitated and carried out through it.





"The last mentioned defect may be lessened "by a perforated tube (see the accompanying "figures,) attached to the end of the cock which "is within the boiler. Such a tube would pre-"vent the current from being concentrated to-"wards the aperture of the cock as the steam "would enter it through the small openings, in "various directions." "The next figure shows a method by which both the "defects to which I have alluded as affecting the gauge-cock, may be reme-"died. The cock passes through the head of "the boiler in the usual way, and is then united "to a perpendicular pipe, open at both ends, and "about two or three inches in diameter. The "lower end of the pipe is four or five inches "below the surface of the water, and its upper "end is carried as far above the level as may "be convenient." "When this cock is opened no current can be formed in

---

* Journal of the Franklin Institute, vol. 9, p. 366, 1832, letter from Thos. Ewbank, Esq. of New York, to the Com. on Explosions.

" the direction of its aperture, and the water in the tube P (which will of course " be at the general level of the water in the boiler,) will not be so subject to " agitation*."

To test the idea that the foam which issues through the gauge-cock is produced by a rush of steam towards the aperture, and the method, proposed by Mr. Ewbank, for lessening it, tin pipes, ten inches and three-eighths in length, and three-eighths of an inch in diameter, with seventy-nine perforations, each about two hundredths of an inch in diameter, were attached to the central and lowest gauge-cocks *b* and *c*, Plate 1. When the level of the water within was about five-eighths of an inch below the cock *c*, or nearly two inches and four-tenths below the cock *b*, on opening the lowest cock, the steam being at a pressure of two atmospheres and two-tenths, a very little water mixed with the steam, passed through the opening of the cock; on opening the middle cock *b*, water and steam flowed through *c;* on closing this and opening the highest cock *a*, less water issued through *c*. When both *a* and *b* were opened, the water flowed copiously through *c*. At the close of this experiment, the glass water-gauge showed that the level of the water within the boiler was one inch below the lowest cock.

In another experiment the water being one inch and a half below the lowest cock; *c* being opened, no water issued; *c* and *b* being opened, a very little water issued through *c; a*, *b* and *c*, being opened, a little water was mixed with the steam.

The facts thus elicited, are in accordance with the preceding observations of the committee in relation to the general foaming which takes place when an aperture is made in any part of the boiler. The great respect which they entertain for the ingenious author of this device, on account of the valuable contributions which he has made to them, induced them to give this full trial of his suggestion.

The third form of apparatus would cut off the access of water from the general foaming, until it reached the level of the lowest apertures; but it would substitute a local foaming which would effectually, if not equally, prevent the true hydrostatic level from being indicated: in this respect it is nearly equivalent to the gauge-cock, already described, as applied to the water-gauge.

Alarm Floats.

The various floats which have been applied to show the level of the water within a boiler are well known. They have never obtained favour in this country, and are considered particularly objectionable in their application to the high pressure boiler, on account of the motion within. The stuffing-box, commonly used to pass the index-rod of the float through the top of the boiler, is objectionable, and different devices have been originated with a view to remedy this difficulty. That of Mr. Thomas Ewbank, of New York, described in volume 16, of the Journal of the Franklin Institute, is highly ingenious, and is reported by him to have stood the test of experience in his small boiler, producing steam of rather less than five atmospheres. The apparatus of the committee did not furnish facilities for a proper trial of this float; and besides, such a trial would be inadequate to test its use in practice.

A float serving to give an alarm by the issuing of steam, was made the subject of a few experiments, and answered well, as far as those trials went. Long use, however, could alone determine, perfectly, the peculiar liabilities to derangement in this apparatus. The float alluded to is shown on Plate 4, fig.

---

* Journal of the Franklin Institute, vol. 10, pp. 80, 81, 1832. " Supplement to the communication of Thomas Ewbank, Esq. of New York, to the Com. on Explosions."

A. The requisite buoyancy is given to the metallic pyramid, *a*, which is solid, by the weight *b*, acting as a counterpoise over the fulcrum *c*. The whole apparatus is attached to the top of the boiler by the screw *d*, and the nut *e*, and the working parts are thus entirely within the boiler. When the water is at the proper level *f g*, the shoulders *h* and *i* are in the same horizontal line, and the disks *k l*, which are pressed against the shoulders by two springs shown in the figure, close the apertures *k m*, and *l n*, which, when open, permit steam to escape from the boiler. Should the water sink below its proper level, the equilibrium of the pyramid *a*, being destroyed, the shoulder *i*, would press against the disk *l*, remove it from the aperture, and permit steam to escape through *l n;* should the water, on the contrary, rise above the proper level, steam would escape through *k m*. The force of the springs which close these openings, should, of course, be duly proportioned, as they will determine the sensibility of the apparatus. The details of construction are clearly shown in the figure, which is drawn to a scale.*

The quantity of steam which would escape by the small opening *l n*, while it would serve as an alarm, would not materially diminish the supply of water within the boiler. The float used by the committee, was found to be sensible to less than three-tenths of an inch in the change of level: it could have been made more sensitive by increasing the breadth between the shoulders, so as to bring them in contact with the disks, as shown in the figure.

Effect of Foaming on the Elasticity of the Steam within the Boiler.

This point was the next proposed for examination. When an opening is made in a boiler, of which the sides are heated, will the effect be to diminish the elasticity of the steam within, by permitting its escape, or will the water thrown upon the heated sides by the foaming which results, be converted so rapidly into steam as actually to increase the elasticity of the vapour within? It is obviously difficult to obtain an answer to a query involving so many conditions. It might be expected, however, that a small boiler would afford satisfactory means of making a fair trial of the question, since the size of the openings could be varied very easily, so as to make them comparatively small, or very great. The position of the boiler used by the committee in its furnace was such, that the sides could be very readily heated; thus placing it in favourable circumstances to increase the elasticity of the steam by producing a foaming within. The apparatus was therefore adapted to make the desired trial.

M. Arago, in his Essay on the Explosions of Steam-Boilers, states, that MM. Tabareau and Rey, at Lyons, found on opening a large stop-cock, connected with a small high pressure boiler, that the safety valve rose, showing an increase of pressure within. The boiler was placed naked upon a fire of charcoal, and the part not containing water was surrounded by flame. The experiments of MM. Arago and Dulong, at Paris, were attended with a contrary result, the opening of a safety valve being always accompanied by a diminution in the elasticity of the steam within. The circumstances, however, were not the same as those in the experiment of MM. Tabareau and Rey.

To repeat this experiment, a hot fire was made beneath the boiler, and when the water had fallen to about three inches above the lowest line of the cylinder, the experiment was commenced, the pressure being about three atmospheres and a half. A stop-cock of .03 sq. inches in area, $\frac{1}{10960}$th part of the area of the water surface at the beginning of the experiment, delivering per second, at three and a half atmospheres, about four hundred and nine cubic inches of steam was first opened; next the safety valve was raised, either in part or entirely, the area when entirely raised, being .208 sq. inches, or $\frac{1}{1050}$ths of the water surface, and capable of delivering, in one second, at three and a half atmospheres, a bulk of steam nearly nine times that of the steam chamber. The water level falling by the waste caused in the experiments, the steam soon became surcharged with heat; and the iron of the boiler, from near the water line to more than one-third of the distance from the lowest line to the middle of the convex surface, became, on each side of the water line, heated until it attained redness, passing, of course, through the temperature of maximum vaporization of the water thrown by the foaming, upon the iron. The experiments were made at intervals, until all the water was exhausted. Water was then injected in small quantities, and with the bottom of the boiler for the most part red hot, the trials were repeated.

---

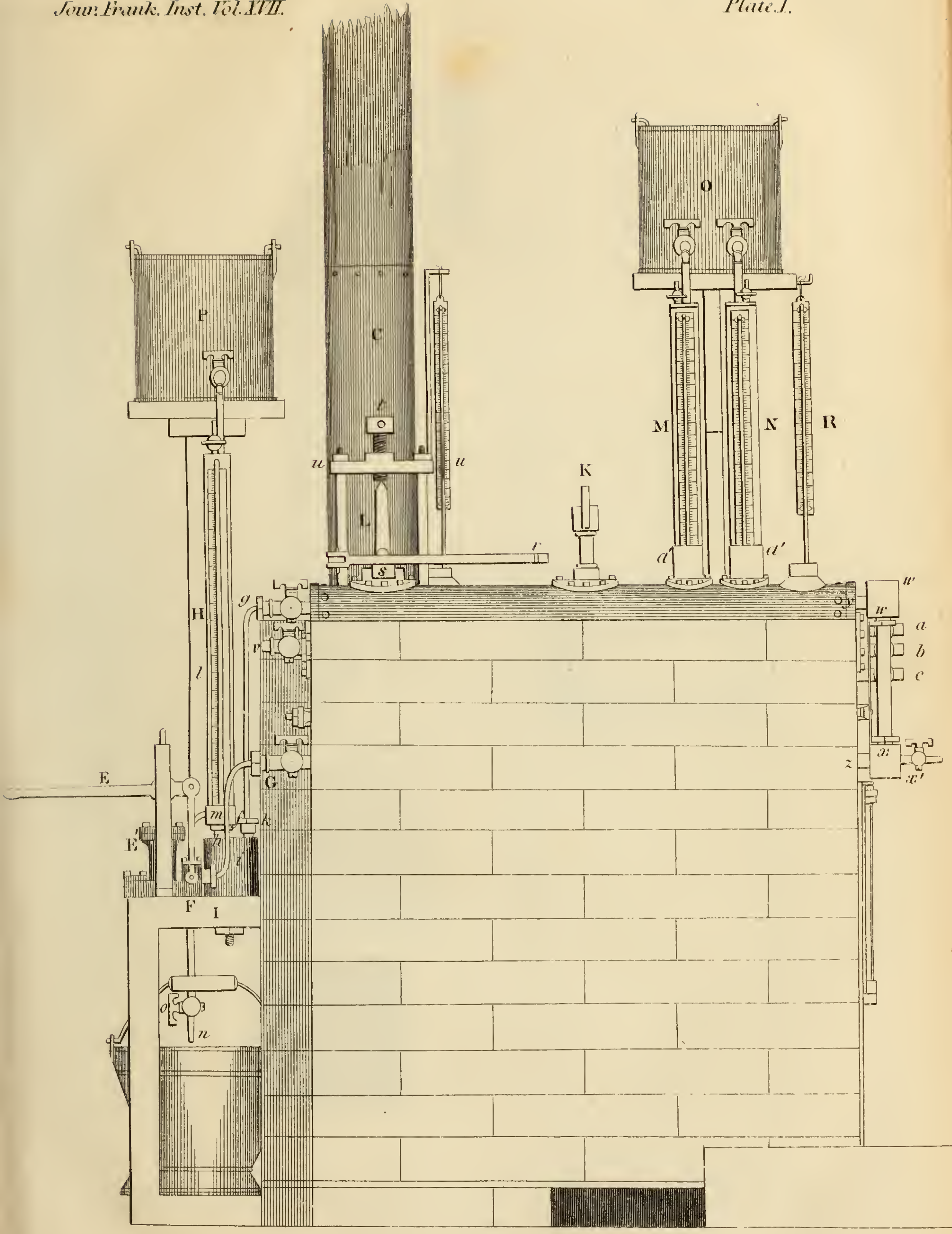
* In the figure, the shoulders *h* and *i*, do not rise high enough; they should overlap the disks more, that no depression or elevation of the water may carry them clear of the disks.

It will be seen from the following table, that the result was uniformly a diminished elasticity of the steam within, as shown by the fall of the mercury in the steam gauge. The pressures varied, in the former part of the experiments, from three and a half to eight atmospheres.

The first column of the table contains remarks referring to the level of the water within the boiler. The second to the opening made. The third is the temperature indicated by the thermometer, M, Plate 1, before referred to, as passing nearly to the bottom of the boiler. The fourth, the height of the mercury gauge, before making the opening. The fifth, the height immediately after making the opening, unless the contrary is stated in the sixth column, which contains remarks relating to the effect on the gauge. The seventh column contains general remarks.

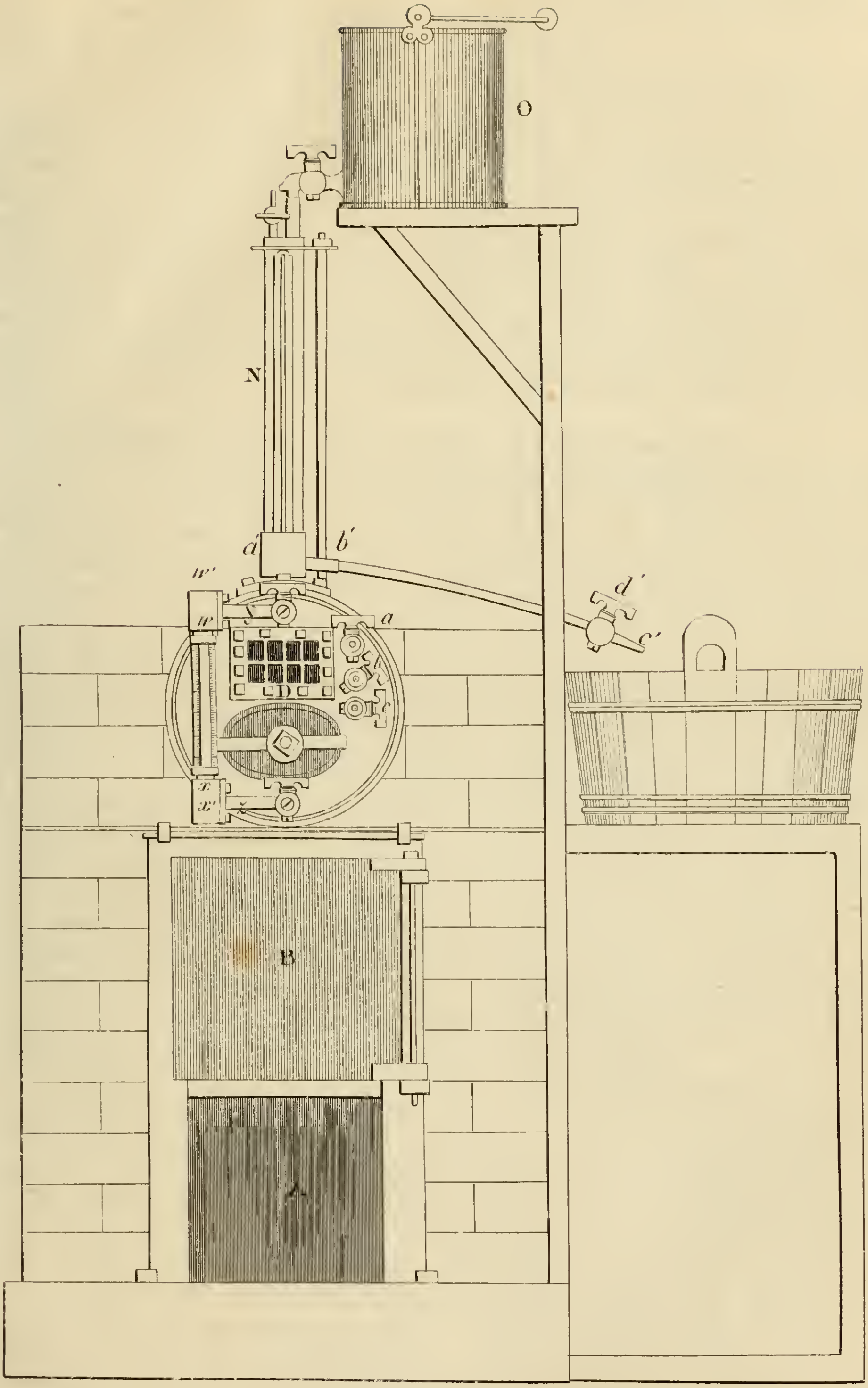
The thermometer at first indicated the temperature of the water, then that of the surcharged steam, and finally was affected by the heat radiated from the bottom of the boiler.

Remarks on Depth of Water.	Nature of Opening.	Temp. by long Ther.	Height of Steam Gauge.		Remarks on the Depression of the Steam Gauge.	General Remarks.
			Before.	After.		
		Fah.°	Inches.	Inches.		
3 inches,	Gauge-cock,	284½	18.6	18.0		Temperature of air in gauge, 80°. Pressure corresponding to 18.6 inches, 3½ atmospheres.
	Do.		20.4	20.2		
	Safety valve,		20.5	20.0	Fall very rapid.	
	Gauge-cock,		21.0	20.9	Fall immediate.	
	Safety valve,		21.3	21.0		Pressure corresponding to 21.3 inches, 5½ atmos.
.9 of an inch,	Gauge-cock,	317½	21.9	21.8		
	Safety valve,		22.1	21.7	Fall in ½ second.	
	Do.		22.6	20.6	Fall in 2 seconds.	From about 8⅛ to 5 atmospheres. Steam surcharg'd, bottom rapidly increasing in heat.
.9 inch nearly,	Stop-cock,	380			Falls.	
	Safety valve,	468½	15.1	12.6		
	Gauge-cock,		18.0	14.0		Water exhausted, supply thrown in. Thermometer rose to 600°.
	Safety valve,		16.0	14.0	Sudden descent.	



Scale 1 inch to the foot.

Engraved by J. Yeager.



Scale 1 inch to the foot.

Engraved by J. Yeager.

II. To repeat the experiments of Klaproth relating to the conversion of water into steam, by highly heated metal, and to make others calculated to show whether, under any circumstances, intensely heated metal can produce, suddenly, great quantities of highly elastic steam:—

The first part of this query relates to the repetition and extension of the experiments of Klaproth, the second has reference to them, but may be determined by direct experiment, independently of the methods required for obtaining an answer to the first part of the query. It has been supposed that because the metal of a boiler was heated above the temperature at which the metal would produce steam most rapidly, it was impossible to account for the production of quantities of highly elastic steam, by such a cause. The committee, determined to make the fact of the production of high steam by intensely heated metal the subject of a direct experiment, and under circumstances as nearly similar as possible to those which may occur in a boiler, of which some parts, as the sides or interior flues, may become unduly heated, when not in contact with water.

The experimental boiler being arranged as already described, a small quantity of water was placed in it and boiled away; the heat being still applied, the temperature of the bottom was gradually raised. At different temperatures of the bottom, water was thrown in by the forcing pump, and the effect of a given quantity, on the gauge, noted. The temperature of the steam generated, was ascertained by a thermometer passing horizontally through the back head *g*, Plate 1, and two-thirds of the diameter above the bottom of the boiler: a second horizontal thermometer as near to the bottom as the rim of the boiler would permit, served to show whether the heat was rising or falling, and was noted for this purpose. Both the windows of the boiler had glass $\frac{3}{8}$ths of an inch thick in them, without the cross bar covering. The water injected was at 70° Fah. The course of the water injected could be distinctly marked after the bottom of the boiler had become heated to redness, and was examined through the glass window *d*, Plate 3. The force of the pump carried it to the fire end, nearly; the boiler being slightly inclined to the back end, the water slid back in one or more dark masses, moving down the central line, or diverted up the sides, greatly agitated and frequently changing its shape. The water generally disappeared at the back end, though parts were retained by accidental spots of sediment, and disappeared upon them. The table below gives the results of the second day's experiments on this subject; they were terminated by violently bursting out the glass window at the fire end of the boiler.

The height of the lower thermometer, as noted by an observer at the back end of the boiler, is given in the first column of the table, with the appearance of the bottom of the boiler, both being examined before injecting water. The gauge was allowed to fall to the height denoting one atmosphere, before giving the number of strokes of the pump, from which the quantities of water, in the third column, are taken. The pressures in the fourth column were noted on the gauge by the same experimenter, who threw in the water. The first effect was examined through the back window, D, Plate 3, and the temperature of the steam produced, before the gauge began to fall, was noted as is recorded in the fifth column. As in all the experiments, the steam was rapidly produced, and the total effect was the object sought, the time was no further noticed than to ascertain that accidental circumstances independent of the temperature, rendered the total time of evaporation very variable, and that the maximum of effect was always passed in the space of from one to four or five minutes.

Temperature of thermometer near bottom.	Appearance of bottom of boiler.	Water injected in fluid ounces.	Pressure produced by injection. Atmospheres.	Temperature of Steam produced by injection.
306	Black.	2	3.3	336° F.
	Do.	Do.	3.4	340
330	Do.	Do.	3.3	356
	Red in part.	Do.	3.7	362
348	Red.	Do.	3.7	376
	Do.	3	4.2	
	Do.	5½	8.2	
384	Do.	5½	8.2	388
418	Do.	7½	8.7	424
428	Do.	10	9.8	448
448	Do.	Do.	12.0 ?	516

In the last experiment, the glass window at the fire end of the boiler, blew out with a quick sharp report, as loud as that of a musket; the fragments of glass, from a hole in the centre of the plate, were projected through a window, about three feet from the boiler, and could not be found. The number for twelve atmospheres is placed opposite to this experiment, as being an approximate result. In the act of observing the gauge, the glass burst, and the mercury at once fell: the number of inches at which the mercury had certainly risen, and above which it was, by an undetermined quantity, not, however, very considerable, was noted; and from this the pressure given in the table, is calculated. Here explosive steam was generated by the injection of water upon red hot iron, and in a time not exceeding one or two minutes at the most, the interval between the last stroke of the pump and the explosion, not having been sufficient to note the height of the gauge; the experimenter being at the pump, which was adjacent to the gauge.

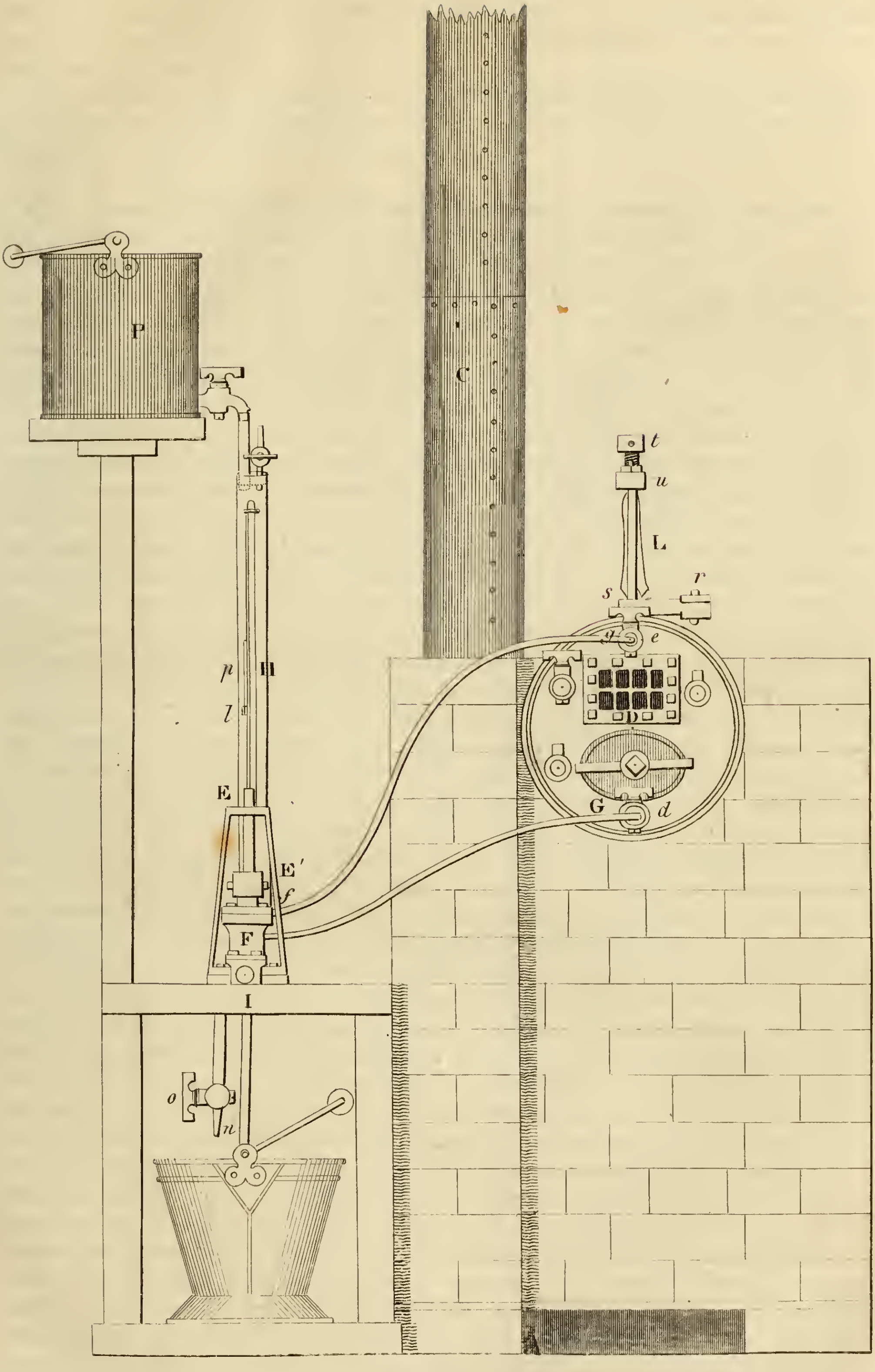
By comparing the temperature of the steam in these experiments, with its observed pressure, it will be seen, that in not one of them was water enough injected to give the steam a density even approaching to that corresponding to its temperature: for example, 336°, F., should give a pressure of nearly 7¾ atmospheres, instead of 3.3, the observed pressure; 388° should give more than 14* atmospheres, instead of 8.2 and 448°; about 27½ atmospheres, instead of 10. The violence of the effect was not, therefore, carried as far as it might have been, the metal not having been cooled down as far as it might have been, to produce the greatest effect; and yet, within two minutes the pressure was changed from one to twelve atmospheres.

The rise of temperature shown in the first column, serves to prove, that by successive introductions of water, the metal was not so far deprived of heat as to be cooled towards the point of maximum vaporization, but that the results were obtained with metal heated to redness.

A similar experiment to these was made by our countryman, Perkins, but surcharged steam being present in the vessel into which heated water was

---

* Arago and Dulong.



Scale 1 inch to the foot.

Engraved by J. Yeager.

forced, it was to the action of this that he attributed his result. This opinion will be examined subsequently, but the attributed source of action was present only in a very attenuated state, if at all, at the beginning of each experiment made by the committee.

The repetition, and extension, of the experiments of Klaproth, was one of the most laborious of the undertakings of the committee, and the results will be found in a future article of the report.

III. To ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour.

The supposition that water, thrown into hot and unsaturated steam, is flashed into highly elastic vapour, forms the basis of the theory of the explosion of steam-boilers, of our countryman, Perkins; a theory which has been embraced by many; and which, though shown to be contrary to the deductions from the well established laws of heat, is not now without its advocates. It seemed to the committee interesting to appeal to direct experiment upon this point, and thus to ascertain whether any circumstances, not embraced in the general view of the theory, existed; or whether all the circumstances had been rightly estimated, and the conclusions drawn from the application of the general laws of heat would be confirmed. Being unwilling to incur any considerable expenditure in this branch of their inquiry, the experiments were rendered uncomfortable beyond any thing which occurred in their other researches. The means of producing the unsaturated steam were these: a row of bricks was removed from the top of the furnace, and near to the boiler, thus laying bare nearly half the convex surface of the latter (five inches from the top). By building on the sides of the top of the furnace, with bricks, loosely arranged, a space was formed for placing fuel, having the boiler for its bottom, and bounded by the bricks on its sides. A cap of sheet iron above, served to promote the draught and to carry off much of the deleterious gas produced by the charcoal used as fuel. The fusible plate apparatus was removed from the boiler, to prevent injury, and the safety valve was surrounded by a tin to keep the fuel from contact with the valve. By filling the boiler about half full of water, and applying heat below, to raise the water to any required temperature, the upper half of the boiler would be filled with steam of an elasticity due to that temperature, this elasticity being measured by the gauge. Fire being now placed upon the top would heat the metal of the upper half of the boiler; and this, by communicating its heat to the steam, would surcharge the latter. To measure the temperature, thus acquired by the steam, as well as that of the water below it, thermometers were placed in the iron tubes already described; the mercury was removed from the tubes, except enough to cover the bulbs of the thermometers, so that the temperature shown by them might be, as nearly as possible, that of the steam by which the shorter tube was surrounded, and of the water, into which the longer tube dipped. The scales of these instruments were protected from the fire, by surrounding them, at some distance, by tin plates. The scales were of seasoned box wood, the refinement of a correction for the errors of the instruments was not considered to be at all required by the nature of the research, the results of which errors, even a few degrees of temperature would not materially affect. In the final experiments, on this subject, the thermometers, with metallic scales, and surrounded by water, were put in place. The apparatus for injecting water, consisted of a tube attached to the stop-cock, *v*, Plate 1, on the back head of the boiler, and which communicated with the forcing pump; the tube terminated in a spherical segment, in which fourteen holes, each of the size of a cambric needle, were made; through these the water was forced in spray. By examination it appeared that the small stream, from the highest hole, struck the top of the boiler near the safety valve; that two or three struck the front head;

two or three the water in the boiler, near the back head, leaving from seven to nine apertures, the water from which crossed the steam chamber in an inclined and very effective direction. The effect of the streams from the three or four apertures, first spoken of, would be, if they were not taken up by the steam, to vitiate, in degree, the experiments, by striking the top and end of the boiler. With the openings, thus described, the first day's experiments on this subject were made. The heat of the surcharged steam could not, with the arrangements then provided, be raised above 484 degrees. The method of experimenting, having been the same as was subsequently used, may as well be stated in this place. The fire having been applied below the boiler, the water was heated to a temperature corresponding to from one and a half to two and a half atmospheres; the coals were then, in part, removed to the top of the boiler, fresh fuel being supplied below: the effect of the heat applied above was soon visible upon the thermometer in the steam, and upon the gauge. When the temperature of the surcharged steam sufficiently surpassed that of the water, as shown by the larger thermometer, the injection of water was commenced, the injection pipe being carefully kept cool by wet sponges and cloths. The temperature of the thermometers in the water and steam, were noticed both before and after the injection, by one experimenter, while a second made the requisite number of strokes of the forcing pump, observed the indications of the steam gauge, and when the experiment was concluded, gave the quantity of water used. The temperature of the air in the gauge was noted from time to time. The apertures in both the heads were secured with metallic plates, to prevent leakage through them.

On the second day, six of the fourteen small holes were plugged up, that the source of error, already mentioned, might not exist. The temperature attained by the surcharged steam was 440°, at, and below which, experiments mere made. The general nature of the results, obtained on the first and second days, coincide, allowing for the difference of circumstances, so entirely with those of the final trial, when a satisfactory temperature was obtained in the surcharged steam, that it would be uninteresting to detail them. The same remark may be made of subsequent trials.

As the quantity of water thrown in, during all these experiments, was small, it was considered advisable to increase it, in order that more marked effects might be obtained; this was done by removing the pierced head from the pipe, thus delivering nearly the full capacity of the pump at each stroke. The quantity of water thus injected through the steam by each stroke of the pump, was, at a mean, half a fluid ounce. No heating of the injection water was required, as the heat necessary to raise water from the temperature of the experiments to the boiling point was but a small fraction of that required to convert it into steam.

In the last day of trial the heat of the top of the boiler was so great and so long sustained, that the thermometer in the water became, in the course of the experiments, for reasons which will be stated, comparatively useless, as an indicator of the temperature of the water. The following tabular view of the results of the experiments is extracted from the minutes. The first column of the table contains the temperature of the surcharged steam, previous to the injection of water in any experiment, the second column that after the injection, this comparison being made to ascertain whether the heat supplied was, or was not, sufficient to make up for that consumed in vaporizing the water thrown in. The third column shows the quantity of water injected; the fourth the height of the gauge before the experiment; the fifth the height after the experiment; the sixth the temperature of the gauge; the seventh and eighth, the pressures in atmospheres, calculated from the height of the gauge, and the temperature of the air within it, before and after each experiment. No notice is taken of the temperature of the scales of the thermometers, it having varied but 10° Fah. namely, from 86 to 96°.

The first experiment is introduced, to show the temperature of the water within the boiler, before the long continued heat had sensibly affected the indications of the thermometer.

Height of Thermometer in Steam.		Ounces of water injected.	Height of Gauge in inches.		Temperature of air.	Height of Gauge in Atmospheres.		REMARKS.
Before exp't.	After exp't.		Before exper't.	After exper't.		Before exp't.	After exp't.	
376		0	21.17		65	5.72		For comparison, no water injected. Water in the boiler, 318° Fah.
462	463	2	21.30	21.25	66	5.85	5.80	
506	509	3	21.50	21.50		6.15	6.15	Gauge stationary.
508	510	7	21.52	21.47		6.21	6.07	
518		0	21.80		70	6.65		Temperature of air in gauge noted between two experiments.
519	521	3	21.80			6.65		Gauge fell slightly, then rose to original level.
522	524	6½	21.80	21.70		6.65	6.48	
526		10	21.80	21.65		6.65	6.41	
528	528	13	21.80	21.60		6.65	6.34	
532		0	21.90			6.82		
533	533	6	21.90	21.85		6.82	6.74	Rose again immediately to 21.90.
533	533	14	21.90	21.70		6.82	6.48	Fell nearly .2 inch. *Note.* 533° is, according to the formula of Arago and Dulong, the temp. of saturated steam of more than *sixty atmos.*

At the close of these experiments, the metal was, in many places, but little short of a red heat, visible in daylight.

The precise state of things in a boiler, of which parts are unduly heated, was represented in these experiments; there was the surcharged steam, and heated metal ready to give up its heat to replace what might be absorbed in the conversion of the water injected, into steam. This latter circumstance renders the case different from that contemplated in the deductions of theory which have been brought to bear upon the question. The greater or less intensity of the heat afforded by the top and sides of the boiler would necessarily modify the effects observed, by the injection of any given quantity of water; this is observable in the numbers given in the table, where although the greater quantity of water injected does not fail in two consecutive experiments to show a greater depression of the gauge, yet in distant experiments the same is not the case. *We see that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse, and in general that the greater the quantity of water thus introduced, the more considerable was the diminution in the elasticity of the steam.* The quantity of water injected was from 3.5 to 24.3 cubic inches. The immediate rise of the gauge after each experiment, shows how rapidly heat was supplied by the sides of the boiler to the steam within.

That the steam was highly surcharged with heat, appears by comparing the pressures corresponding to the temperatures, with those given by Dulong and Arago, for saturated steam. For example, the pressure shown by the gauge when the steam was at 506° Fah. was 6.15 atmospheres, while the table just referred to gives for this temperature a pressure of *forty-eight atmospheres.* The temperature was carried to 533° Fah. when the pressure shown by the gauge was 6.82 atmospheres, while saturated steam at that temperature would have had a pressure of more than *sixty atmospheres.*

In order to ascertain whether the thermometer relied upon to give the temperature of the steam was affected, if at all, in excess or defect by the conducting power of the metal; the temperature of the boiler just beyond the tubes was taken, as nearly as was practicable, by a thermometer, R, Plate 1, dipping into a clay receptacle, upon the top of the boiler. This thermometer did not rise above 405° Fah.; its distance from this source of heat was ten inches, and that of the iron tube inclosing the thermometer, six and a half inches. Supposing the temperature stationary on top, the temperature of the metal of the top of the boiler near the tube of the thermometer would have been 479°,* showing that it tended to carry off heat from the thermometer, which, if at all affected by the metal above it, showed too low a temperature for the steam in contact with it. The temperature of the source of heat would have been from these data, 582° at the extreme end of the part covered with fuel, which was of course at a lower temperature than the middle portion.

On examining the apparatus after the conclusion of the last day's experiments, it was found that some of the putty used in tightening the lower joint of the thermometer in the water, had been softened by the heat, and had flowed into the tube, thus affording a direct communication between the steam and the bulb of this thermometer: this circumstance accounts for the instrument being affected in this day's experiments and not in the preceding ones.

---

* If we suppose the heat of a small bar of metal, cut from the top of the boiler, to have been derived by the conducting power of the metal alone, the heating effect of the steam within being neglected, and further, that the temperatures of the bar had become constant, then the ratio of the excess of the temperature (y) of any point at a distance (x) above the temperature of the air, to that (y') of any point at a distance, (x',) is given by the proportion,

$$y' : y :: \text{Log. } x : \text{Log. } x'.$$

In the case before us, $y = 405 - 80 = 325°$, $x = 10.0$ inches, and $x' = 6.5$ inches, whence $y' = 399°$, and the temperature at that point is $y' + 80 = 479°$.

To find the temperature of the source of heat, we have the equations—

$$y' = A\, e^{-x'\sqrt{\frac{2h}{kl}}} \quad \text{and } y = A\, e^{-x\sqrt{\frac{2h}{kl}}}$$

in which y' and y are the excesses of the temperatures at the distances x' and x over that of the air. A is the temperature of the source, e the base of the Naperian logarithms, $2l$ the thickness of the bar, and $\frac{h}{k}$ the ratio of its radiating to its conducting power. To find $\sqrt{\frac{2h}{kl}}$, which is the same for the two points x and x'; we have

$$\frac{y'}{e^{-x'\sqrt{\frac{2h}{kl}}}} = \frac{y}{e^{-x\sqrt{\frac{2h}{kl}}}}, \text{ whence Nap. log. } y' + x'\sqrt{\frac{2h}{kl}} = \text{Nap. log. } y$$

$$+ x\sqrt{\frac{2h}{kl}}, \text{ and } \qquad \sqrt{\frac{2h}{kl}} = \frac{\text{Nap log. } y' - \text{Nap. log. } y}{x - x'}$$

in the case before us, $\sqrt{\frac{2h}{kl}} = .058$ and $\log. A = \log. y' + x'\sqrt{\frac{2h}{kl}}.\ \log. e = 2.765$,

and therefore $A = 582°$.

The boiler must have been hotter at the furthest point than it would have been if not in contact with the surcharged steam.

(*To be continued.*)

Fig. A.

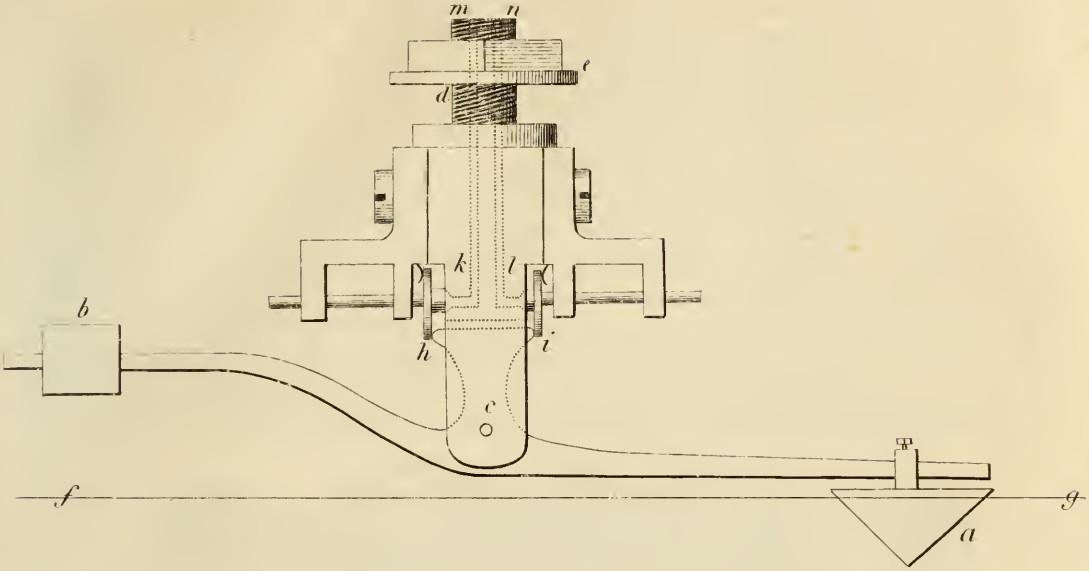
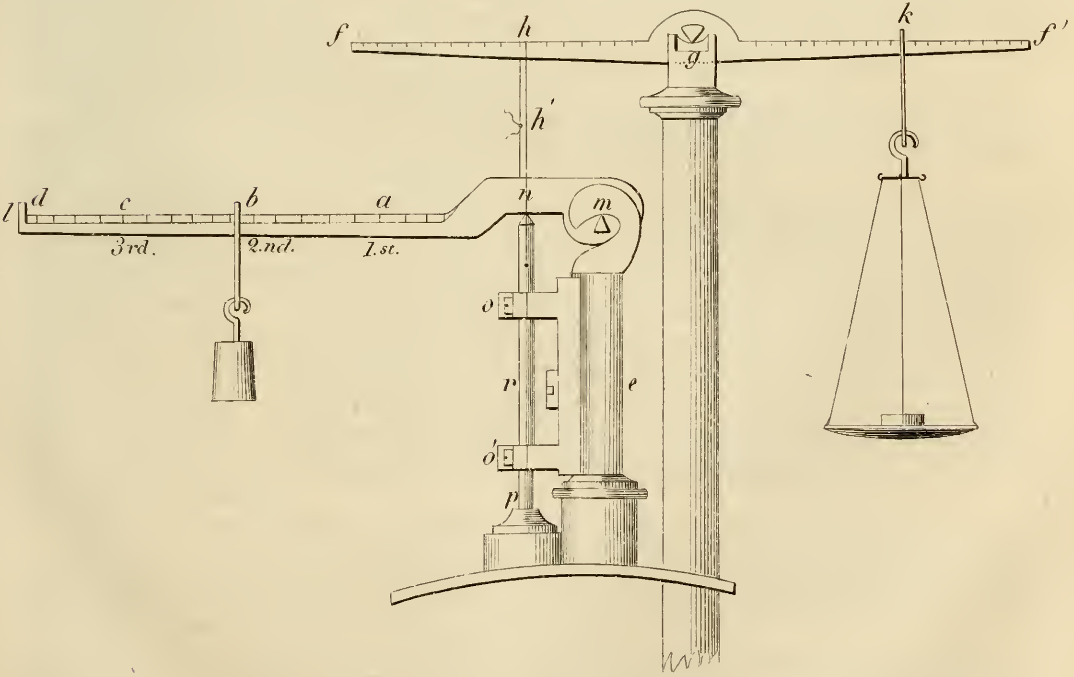


Fig. B.



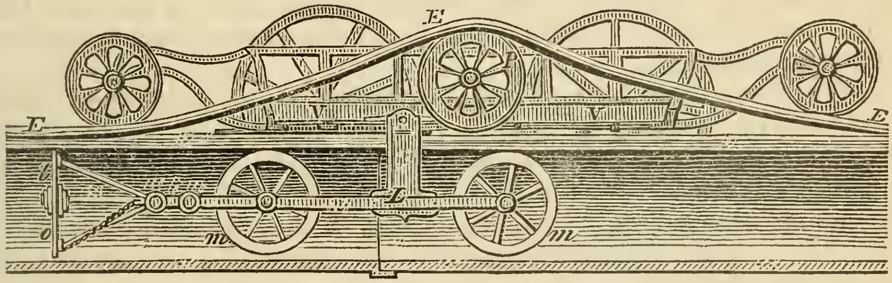
Engraved by J. Yeager.

Pneumatic Railway.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

A very warm controversy has been carried on in the pages of the London Mechanics' Magazine, in relation to the pneumatic railway recently patented by our countryman, Mr. Pinkus, now a resident of London. To give the readers of this journal an idea of the nature of this patent, a cut is subjoined, representing a section of the tunnel forming the railway, and showing the carriage to be propelled in its connexion with the tunnel.

The method of propulsion is by rarifying the air in the conduit pipe in front of the shield *o*, which is supposed to move air tight. The pressure of the air behind the shield will then urge it forward. This shield, or as Mr. Pinkus terms it, "dynamic traveller," is connected with guide wheels *mm*, which keep the bar S L in the axis of the tube. To this bar is connected an upright arm, *p*, passing through a slit in the upper side of the pipe or tunnel, and intended to transmit the motion of the *shield*, *l o*, to the car, V V. The slit thus required in the upper side of the tunnel is closed by a "square cord," shown in the figure, E E E, passing over one and under two wheels; the middle wheel lifting the rope as the carriage, V V, proceeds, and the front wheel guiding it to its place upon a groove made to receive it, and thus closing the slit. The car, V V, or "governor," as it is termed in the specification of the patent, moves upon two rails, attached one to each side of the tunnel, and parallel to its axis.



Mr. Pinkus claims, as new, these various arrangements, with minor ones not described, and disclaims, as old, the use of the tunnel as a means of transport for goods, &c. in its interior.

The prospectus of "a National Pneumatic Railway Association" was accompanied by the opinions of Dr. Lardner and Prof. Faraday in regard to this means of locomotion. The opinion of the former gentleman was decidedly favourable. The practicability of the scheme he does not doubt. Considers it a frictionless mode of transferring power to a distance. Calculates the necessary rarifaction to be produced in the tube or tunnel, and the power obtained. The relative economy of this new, and of the *old* rail way. The diminution of accidents to cars, and upon inclined planes. Examines the difficulties of keeping the tunnel air tight, and concludes that they are not insurmountable.

Mr. Faraday modestly remarks, that he possesses no *practical* experience in regard to railways, but approves, in general, of the principles of the pneumatic railway, and enumerates some advantages which will accrue from its substitution for those of the ordinary kind.

The editor of the Mechanics' Magazine, notwithstanding the weight of authority thus against him, contends, that both in theory and practice, this project is to be condemned, and quotes the experiments of Papin and others to show that air is not to be passed through tubes without friction. He refers, also, to the unsuccessful attempts of Valance to press air through a tunnel. These and other experiments to the same purport, the reader will find in vol. ix. of this Journal. A committee of the Institute reported upon a plan identical in *principle* with that of Mr. Pinkus, and the table drawn from the best experiments on the resistance of air to motion through tubes, shows how much power would be consumed in producing a given effect in a tunnel of a given length.

Here the view is taken, that the operation of drawing the air *out* of a tube, is of the same nature with that of forcing it in.

But on the contrary, Mr. Pinkus, in a reply to the editor of the Mechanics' Magazine, states that Mr. Hague has succeeded in applying the principle of Papin to communicate power to the distance of even seven miles, and that in one of his works, the power of a seventy horse steam engine is transmitted undiminished, and instantaneously, through a tube three miles in length. He further states, that the gas for lighting Birmingham is brought seven miles through pipes, with but a small diminution of force. Of the apparatus of Mr. Hague we have heard for the first time, but must remark that the latter fact is in contradiction to all the experiments hitherto made on the passage of gas.

The readers of this Journal would probably not be interested in the personalities of the articles in relation to this subject, and they have before them the means of forming a correct conclusion as to the merits of the pneumatic railway.

As one of the readers, I cannot approve of the scheme either in theory or practice. Not in theory, because of the consumption of power required to rarify the air in a long tube. Not in practice, from the primary difficulty of the long, uniform cylinders or tunnels required for the motion of the piston; and the secondary one, of the improbability of an air tight joint resulting from the "square cord" and groove. B.

Query in relation to the appropriate colour for the covering of the pipes of Condensers used in the manufacture of Gas.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—Allow me to request from any one of your correspondents a reason why the pipes used for condensers at the Philadelphia Gas Works, are painted white. I understand their object to be to expose the gas as it comes from the retorts to the cooling action of the air. If so, the metal should be covered with some dark coloured paint, which, radiating better than the white, will keep the metal cool, and thus more effectually cool the gas. I take it for granted that the iron of the pipes forming the condenser must be coated to keep it from the effects of the weather, and if I am *right* in regard to the philosophy of the matter, the engineer is *wrong*.

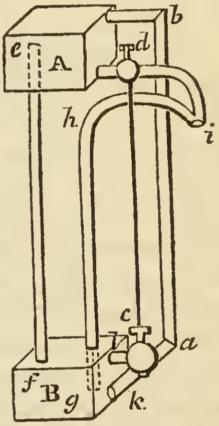
Yours, &c. K.

Substitute for a Waste Cock to Hydrants. By Robert Cornelius.

It is well known, that to prevent the freezing of water contained in the pipes of our hydrants, a waste cock has been applied to the lower part of the pipe through which water is drawn. This cock is opened by the same operation which closes the escape pipe. The water from the escape pipe issues out, therefore, and passes into the ground.

Newton's patent hydrant conveys the waste water to a box, and remedies the inconvenience occurring from the process just alluded to.

The invention of Mr. Cornelius is to effect the same object. His arrangements, as explained at the last conversation meeting of the Institute, will be understood by referring to the annexed diagram. The parts are not there disposed as they will be in practice; the apparatus would want compactness in this form: they are displayed for the sake of explanation.



The box, A, is connected with the top of the hydrant, and B is placed below the ground so far as to prevent the water in it from freezing. The pipe, *a b*, is connected, near *a*, with the branch pipe, *k*, from the main water pipes, and at *b*, with the upper part of the box, A. The stop cock, *c*, opens or closes at pleasure the end, *a*, of the pipe, *a b*. This cock has two passages, one opening from *k* to *a b*, the other, through *l* to B. When one of these is open the other is closed, and vice versa. It is connected by the rod, *c d*, with the cock, *d*. When water is to be drawn, these cocks are brought into the position shown in the figure, when *c* is open and *d* closed; the water flows through *c*, and rises into the tube, *a b*, filling the box, A. The stop cock, *d*, being closed, the air from A passes by the tube, *e f*, into B, and escapes through *g h* at *i*. When the water has risen above the mouth, *e*, of the tube, *e f*, *e* being near the top of the box, A, it flows through *e f* into B. At first the compressed air in B finds a vent through *g h*, but soon the water rising above *g*, seals the pipe, *g h*, and the air is compressed in the upper part of B, until the elastic force is equal to that which the head of water can produce. The water in B meanwhile rises in *g h*, and at length escapes at *i*. When the hydrant is to be stopped, the cock, *d*, is turned. The same turn which opens *d*, closes the passage from *k* through *c* to *a b*, and opens that betwen *a b* and B. The cock, *d*, being open, the water from the box, A, flows out at *i*. The air in B passes through the pipes, *a b* and *e f*, into A, and the water which is in *g h*, and with any which may not be carried by the air through *a b*, descends into the box, B. The dimensions of the boxes, A and B, being duly regulated, and the pipes, *h g* and *e f*, properly placed, this hydrant will be very efficacious.

The quantity of water contained in the upper box, A, must flow from the hydrant after the stop cock, *d*, has been turned.

Civil Engineering.

Report, to the President and Directors of the Sandy and Beaver Canal Co., By E. H. Gill, *Civil Engineer, and Chief Engineer of the Sandy and Beaver Canal.*

Gentlemen,—In compliance with your request, I have the honour to lay before you the following report of the present state of the work under my direction:—

During the past summer the whole line has been minutely traced, with a view to a permanent location: by this survey the total extent of canal has been reduced three miles, or the distance from the Ohio river at the mouth of Little Beaver creek to the western termination at the Ohio canal, by the recent examination and location will not exceed seventy three and a half miles.

The Eastern division of the canal, extending from the Ohio river to a point two miles west of New Lisbon, embraces a distance of about twenty-seven miles, of which seventeen miles are "slackwater:" for this description of improvement the stream is exceedingly well adapted, the valley being narrow and the banks bold and prominent, affording numerous and eligible sites for the locks and dams, and an abundance of good materials for their formation.

The summit or middle division is about fourteen and a half miles in extent, and the Western division, terminating at the Ohio canal, about thirty-two miles. The latter division extends through a country affording the greatest facilities for constructing a cheap and permanent improvement; the valley of the creek is broad and has nearly a uniform declivity from its source to its confluence with the Tuscarawas. On the Eastern division the lockage is four hundred and sixty-four feet, and on the Western two hundred and five, constituting in all six hundred and sixty-nine feet. In locating the Western division, the level has been kept up from Williams' mill dam to the debouch into the Ohio canal at the flourishing town of Bolivar, by which arrangement an excellent water power is secured to the Company, affording a head and fall of twenty-six feet: the owners of the property at the site selected for using the water have liberally ceded to the Company ten acres of very valuable land for that purpose. Sandy Creek at that point will yield a sufficiency of water, independent of the requisite supply for the canal, *at all times to work* twenty, and for eight months in the year fifty *pairs of mill stones.* This power may reasonably be estimated as worth $6000 per annum. Many other valuable sites for hydraulic purposes have been created or purchased along the route, which, in conjunction with the one above mentioned, will probably afford the Company a revenue of $7000 per year.

On the Eastern division of the line, forty-nine sections, or twenty-four and a half miles of canal, thirteen dams, and forty-six locks, are now under contract: on the Middle division, twenty-one sections or eleven miles, including the tunnels and the reservoir mounds on the west fork of Little Beaver Creek and Cold Run: and on the Western division twenty-eight sections or fourteen miles, eleven locks, one dam, and the aqueduct over the Tuscarawas river, constituting in all forty-nine and a half miles of canal, fourteen dams, fifty-seven locks, one aqueduct, aud two reservoir mounds now under contract.

The work has been prosecuted in most cases with energy, and is now in a greater state of forwardness than could reasonably have been anticipated, considering that the season was far advanced when it was commenced. About thirty-four sections or seventeen miles of canal are now completed, and likewise the mason work of two locks, and 144,000 cubic yards of excavation removed from the summit deep cuts: dam No. 2, on the Western division, will probably be completed next week.

The foundations of five other locks and two dams are laid, and 1500 perches of wall built; and a large quantity of stones and other materials for the construction of locks and dams is prepared and on the ground; and I have no doubt all the work now under contract, excepting the tunnels and aqueduct, will be finished in the approaching year.

The work placed under contract is in most instances in the hands of responsible and efficient men, and has been taken on terms exceedingly favourable to the Company. There is at the present period on the line a force equivalent to 2160 men. The cost of the locks, which are built in the most durable manner of cut sandstone, will not exceed $700 per foot lift, being about thirty per cent. below the ordinary cost elsewhere. The cost of the dams, which are in most instances fourteen feet high, will average about twenty-eight dollars per linear foot across the stream; and the canal, exclusive of locks and dams, generally from $3000 to $5000 per mile.

A contract has been entered into for furnishing the remainder of the hydraulic cement; it is found in abundance contiguous to the line; the quality is equal to any I have seen, and the cost extremely moderate.

The contract for excavating the tunnel and approaches, has been taken by energetic and persevering contractors on reasonable terms, the former not exceeding the estimated cost: this work is to be completed by May 1837. As much has been stated in relation to the adequacy of the supply of water on the summit, it may be proper to remark, that during the past season I commenced and have continued a series of minute examinations of the most prominent streams relied on for a supply: those examinations have thus far fully corroborated the truth of the statements and calculations embraced in the report made to you last autumn by Mr. Hage and myself. I feel fully satisfied, that with the aid of the reservoirs that can be constructed on the summit, at a moderate cost compared with their utility, a much larger quantity of water may be introduced into the summit and its dependent levels, than will be requisite for the transit of the immense trade that is destined to seek a market through its channel. The reservoirs now under contract will contain as follows: West Fork reservoir, 130,000,000 of cubic feet; area 350 acres: Cold Run reservoir, 88,000,000 of cubic feet; area, 250 acres: in addition to which it is proposed to elevate the banks of the canal so as to retain one foot in depth of available water, and flood several pieces of low ground on its northern or upper side, amounting in all to about 150 acres, which, when full, will furnish about 6,500,000 of cubic feet, making in the aggregate from these sources alone, an available supply of 224,500,000 cubic feet of water, a demand on which *may* be requisite in a dry season for a period of 100 days. By calculation it will be perceived, that these reservoirs will afford for that period 2,245,000 cubic feet of water per day, equivalent to a discharge of 1559 cubic feet per minute. If to this sum is added the minimum natural flow of water on the summit as reported to you last autumn, (558 cubic feet per minute) it will be observed that the flow of available water in a dry period will amount to 2117 cubic feet per minute, or sufficient, after deducting all that the nature of the soil and climate will require for leakage, filtration and evaporation, for the passage of 185 *boats per day.* The West Fork and Cold Run reservoirs are about one mile apart: when filled, the surface of the water in each will occupy the same plane, or be elevated to the same height: it is designed to have a feeder extending from one to the other, so that the surplus water in one can be admitted into the other, if required. A large waste weir is to be constructed on this feeder for the purpose of discharging the waste water when both reservoirs are full. This water, when thus discharged, is conducted into the reservoir on the summit level. The first two mentioned reservoirs will receive the drainage of twenty-four square miles of country; the summit, *the drainage of eighty square miles.* The usual depth of rain that falls in this section of country can, I am informed, with safety be premised at thirty-six inches per annum, or equal to a column of that height, being 83,635,000 cubic feet on a square mile, and on twenty-four square miles 2,107,244,800 cubic feet annually. From experiments made on a large scale elsewhere, for practical purposes, it has been ascertained conclusively, that seventy-five per cent. of the rain that falls can be laid up in reservoirs. From this data it will be observed, that the three reservoirs above alluded to may be filled seven times per year. This exhibit will probably satisfy the most sceptical as to the adequacy of the supply of water. As to the immensity of the trade that will wend its way through the Sandy and Beaver canal to an Eastern market, I believe there has never been surmised a doubt: a glance at the map will prove conclusively that a very large portion of the produce of Michigan, Illinois, Indiana, Kentucky and Ohio, which are rapidly increasing in population and wealth, must be wafted through it. The business of that section of country is now to a great extent accommodated by the New York improvements, but the completion of the Sandy and Beaver canal will secure to it a safer transit to and from the seaboard, much shorter, and *navigable six weeks earlier in the spring and three later in the fall* than the one now traversed; being sufficient inducements to secure it. What the extent of that trade will be, time alone can develope. On the Erie and Champlain canals, a very large portion of the business done on the first of which is derived from the country above mentioned, there have been received in tolls in 1829 $759,055, 1830 $1,032,476, 1831 $1,194,610, 1832 $1,196,008, 1833 $1,324,521, 1834 $1,292,956, and there is no doubt that the business of this year will greatly exceed the last. On the Ohio canal there was collected in 1832 $82,867, 1833 $136,920, 1834, $151,287, and the amount of tolls received the present year at some of the collectors' offices exhibits an increase of forty-five per cent. over the last.

When the canal or rail-road authorized by an act of the legislature of this State at their last session, to be constructed from the western termination of the Sandy and Beaver canal to the Miami canal, near the mouth of the Auglaise river, shall have been completed, it must add an immense revenue to your work, as it, in connection with the Wabash and Erie canal through Indiana, and the contemplated rail-road through Illinois to the Mississippi river, will constitute a continuous chain of internal improvement, extending westerly from the Sandy and Beaver canal 500 miles, and from Philadelphia 1000, into the rich and fertile regions of the west.

The following synopsis of the distance the trade of the country situated west and south-west of the Sandy and Beaver canal would have to travel from the western termination of that work, in order to reach a market by the various routes now or about to be, afforded it, will fully justify the conclusion that it must seek a passage through it.

Distance by the Ohio Canal, Lake Erie, New York Canal and Hudson River to New York.

From the Sandy and Beaver canal to Cleveland	80	miles.
From Cleveland to Buffalo . . .	200	"
From Buffalo to New York . . .	515	"
	——	"
Total	795	"

Distance by the Ohio and Mahoning Canals and Pennsylvania Rail Road to Philadelphia.

From Bolivar to Akron . . .	42	miles.
From Akron to Beavertown . . .	114	"
From Beavertown to Pittsburg . . .	28	"
From Pittsburg to Philadelphia . . .	394	"
Total	578	miles.

Distance by the Sandy and Beaver Canal and Pennsylvania Improvements to Philadelphia.

From Bolivar to Beavertown . . .	87½	miles.
From Beavertown to Pittsburg . . .	28	"
From Pittsburg to Philadelphia . . .	394	"
Total	509½	miles.

From the rapid increase in business on the New York and Ohio canals, it is to be presumed that when the Sandy and Beaver canal shall have been finished, the tolls on the Ohio canal will amount at least to $400,000 per annum; and from the foregoing facts and statements it is to be inferred, that two-thirds of that trade will pass through the Sandy and Beaver canal, which would nett the holders of stock in that work, at the rate charged on the Ohio canal, an income of at least $60,000 the first season.* If to this sum is added the amount that may be anticipated from the liberal grant contained in the amended charter,† which cannot fall short of $150,000, the Company will receive, in the first year after the work is finished, $210,000 in tolls—independent of the large business that may be expected from the country west and north-west of the termination of their work—presenting the novel result of a canal yielding seventeen per cent. on its entire cost the first year after its completion.

All of which is respectfully submitted.

E. H. GILL, Chief Engineer *S. and B. Canal Co.*

New Lisbon, Ohio, Nov. 11, 1835.

Physical Science.

Of the Tidal Motions of Conductors, free to move. By Jno. W. Draper, *Christiansville, Mecklenburg, Va.*

1. "‡Dans d'autres circonstances on observe encore au milieu des masses liquides, des mouvemens singuliers qu'il est excessivement difficile

---

* The estimate may seem large, but it must be kept in mind that the Sandy and Beaver canal will constitute a connecting link between two large and important works, (the Ohio and Pennsylvania canal improvements) now completed; consequently it has not, like other canals, to await the growth of business.

† The amended charter secures to the Sandy and Beaver Canal Co. all the tolls collected on the Ohio canal from boats that have passed through the Sandy and Beaver canal for seven years after its completion.

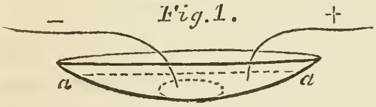
‡ In other cases there occur in liquids, singular motions which are so numerous and changeable as to be very difficult to describe. I shall attempt to give some notion of them, remarking, however, that notwithstanding the many experiments which I have made on the subject, I have not been able to determine any general law respecting them.

de décrire, tant ils sort nombreux et changeans. Je vais essayer d'en donner une idée, en remarquant toutefois, qu'après avoir fait de nombreuses expériences sur ce sujet, il m'a été inpossible d'en saisir la loi."—(Pouillet.)

2. The singular movements here spoken of by Pouillet, have likewise drawn the attention of several other philosophers. Erman and Serullas have both recorded instances of gyratory motion, produced in certain bodies, especially mercury, by the contact of others. There is also a similar observation, made by some of the earlier chemists, respecting camphor. Strange motions of an analogous description, are also observed in some liquids, under the influence of a voltaic current; these, in the case of mercury, have been particularly studied by Sir J. Herschel, who obtained several remarkable notices respecting them; they are, however, so far as I am informed, as yet without explanation.

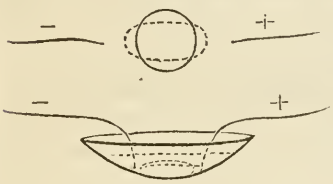
3. If into a watch-glass, or shallow capsule, as *a*, *a*, fifty or sixty grains of mercury is poured, and over that as much water acidulated with sulphuric acid, as is sufficient to cover the surface of the mercury, and the positive and negative wires of a battery of twenty or thirty plates, arranged as indicated in figure 1, the mercury being in contact with the negative pole, and the positive pole being plunged into the water, at a short distance from it, currents are produced, both in the water and in the mercury. Supposing the power of the battery sufficient, the same effect takes place on removing the negative wire out of the mercury, into the water; but if the positive wire is in contact with the mercury, and the negative with the water, there is no motion at all, or at most, the mercury only curls itself up, into an elongated figure.

Fig.1.

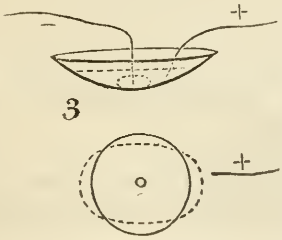


4. This motion varies according to several circumstances, but chiefly the position of the two wires. 1st. If the wires be as in figure 2, or on opposite sides of the mercury, the metal instantaneously elongates as shown by the dots, and currents also are seen playing in the water. 2nd. If the negative wire be introduced into the centre of the metallic globule, and the positive wire be brought on one side, as in figure 3, the mercury will bulge out *elliptically*, at both sides, nearest and furthest from the positive pole —and by regulating the force of the battery, either by changing the number of the plates, or altering the strength of the solution acting on them, the experiment may be so managed, that no motion shall ensue in the mercury, after this elliptical bulging is effected; but now, if the negative wire is cautiously raised from its position, so as to be just out of contact with the surface of the metal, as in figure 4, the mercury is immediately convulsed, and its whole surface covered with a kind of circular waves. On lowering the negative wire to its former position, and advancing the positive, as in figure 5, the moment it comes to the edge of the mercurial ellipsoid, the most intense convulsions are produced, which increase

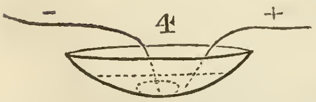
2



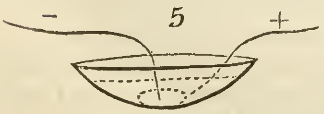
3



4

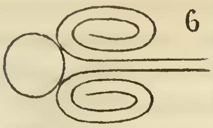


5



until contact of the mercury and wire is obtained. 3rd. If the two wires form a kind of triangle with the globule, it turns upon itself.

5. At the same time that these movements are going on in the mercury, the surface of the water is ploughed by gentle currents, exactly resembling those produced by a breath from a blowpipe, directed slantingly across the surface, as in figure 6.

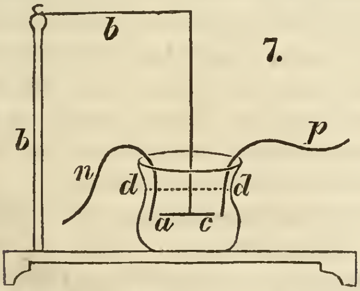


6

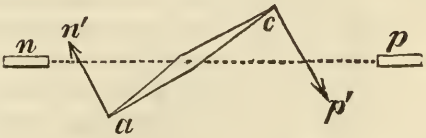
6. In proceeding to give an explanation of these motions, I shall not follow the analytical course of experiment, used in my researches, but commence with those principles, on which a true explanation is founded.

7. It has long been known, that the elements of compound substances, were held together in virtue of an affinity among themselves. Sir H. Davy, Berzelius, and other chemists, were led to suspect that this was due to the electric condition of those elements, and pursuing this hypothesis in its details, several brilliant discoveries were made, which ultimately changed the face of the science. Apart, however, from all hypothetical reasoning, it was found, that the poles of a voltaic battery had the power of influencing the atomic constitution of bodies, so as to be able to hold all chemical combination under control. This remarkable effect was imputed to the electrical attraction and repulsion of the battery—but a battery which is competent to the rapid decomposition of water, and even the reduction of potash, is found to give exceedingly faint traces of any electro-dynamic effect, being unable to cause the divergence of a delicate gold leaf electrometer, or affect the indications of a torsion balance. In the course of certain experiments, I had occasion to notice, that this effect, as to intensity, is entirely regulated by the medium in which the experiment is made; as for instance, a thin lamina of air, or gaseous matter, is nearly a perfect non-conductor to electricity of low intensity, but an expansion of water offers no such resistance. I hoped, therefore, that though I might not be able to exhibit the attraction of a polar wire for a suspended needle in the Coulomb balance, such an effect might ensue, if the experiment was made with the apparatus plunged in another atmosphere, whose conducting power differed from that in which we live. For the conducting power of a medium has no relation either to its cohesion or its chemical properties, and it did not appear improbable, that one might be found, which, though it should not interfere with the freedom of motion of a wire plunged in it, its conducting power, in relation to electricities of very low intensity, might exhibit those effects in a more elevated point of view.

8. To illustrate this reasoning, I took a platina wire, *a*, *c*, figure 7, two inches in length, and suspended it by a raw silk thread from a stand *b*, *b*, into a vessel filled with acidulated water, as high as *d*, *d*. The needle was so arranged, that when it hung with freedom, it was about one-fourth of an inch distant from the extremities of two platina pointed wires, *p*, *n*, which



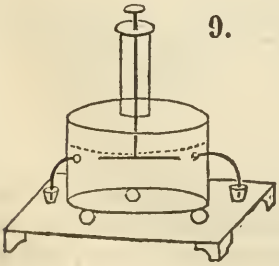
7.



8.

entered the vessel on opposite sides, and could be made to communicate at will, with the opposite poles of a battery. Now the wire p, being positive, and n negative, the extremity a of the suspended needle would be negative, and the extremity c positive, by induction. The conjoined effort of the forces thus brought to bear on the needle, acting on its opposite extremities, in opposite directions, would solicit it to move on its axis, the extremity a in the direction n' figure 8, and the extremity c in the direction p', the line of rest would be as expressed by the dots in the figure, and slow oscillations should take place on either side of that line, if the density, or other properties of the medium permitted.

9. The experiment was thus tried, and to prevent any derangement from hygrometric twist of the silk, the needle was hung on a glass thread, of sufficient length to reach above the surface of the water, and there attached to the silk; on passing the current of forty-five pairs of four inch plates, the needle immediately moved, and after two or three oscillations, took its position of rest; on being moved to the opposite side of the polar wire, an opposite motion ensued, until the same position was gained. During this movement, gas was freely liberated from the extremities of the polar wires, and also from both ends of the needle, which hindered considerably that freedom of motion, which I had hoped for in observing the oscillations. The experiment was also varied, by terminating the polar wires with plates of platina, with a view of increasing the effect; the needle was also suspended in pyroligneous ether, and the attractive power of the same battery, newly charged, was very marked; it was not so observable in alcohol, and still less in muriatic acid; in ammonia, though only one end of the needle appeared to evolve gas, it was not so obedient to the attractive force. These circumstances indicate that the phenomena of motion, as here exhibited, have not their origin in any magnetic action produced either by the disturbance of the earth or the passage of the voltaic currents. Magnetic action to be complete, requires that the bodies, along which currents are passing, should be possessed of high conducting power, hence a thermal current whose tension is almost extinct, is still capable of producing a powerful effect on a suspended needle. A current capable of producing a given deviation when moving along metallic wires would meet with resistance in passing through water, and alcohol, or ether would forbid its passage. It is moreover impossible to produce any visible effect on the platina wire of this arrangement by the action of a solitary pair, even possessing extensive surface, though the same pair if cut into lesser plates, and arranged for the production of a current of greater tension, immediately causes the movement here described. Dr. Faraday has stated, in his recent researches on this point, that there is not any proof that the poles of a battery do exercise any power of attraction or repulsion, (Bache's, Turner's Chem. page 102, idem 108,) but that opinion would appear to be inconsistent with the fact—there must be an accumulation of tension on an electrode, if the medium which separates it from its fellow, is not so good a conductor as the liquid filling the cells of the battery; and experiment warrants this conclusion.



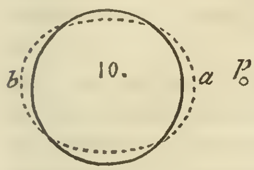
9.

10. The principles here laid down, also indicate the construction of a Galvanometer, figure 9, which I have recently fitted up. It is intended to exhibit by the torsion of a fine fibre, the force of attraction between the polar wires, and the ends of the suspended needle. The only obstacle I have as yet observed to the accu-

racy of the result furnished by it, is due to the development of gas on the polar wires, and on the needle.

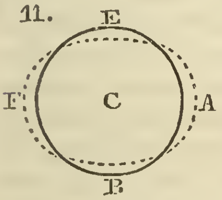
11. The doctrine which I wish to establish from this experiment, is, that though the polar wires are plunged in a conducting medium, and the current is actually passing, yet they still act as centres of attraction. The motions of mercury and other fluids are only exemplifications of this doctrine.

12. When a spheroidal mass of conducting matter, is brought in presence of a point of attraction, situated at a distance from its surface, the particles on that surface will be differently affected, as their situation in regard to the attracting point varies. Thus on touching the mercurial globule, named in the first part of this paper, with a negative wire, and introducing into the water a positive platina pole, the globule, which before was spherical, becomes elliptical, as represented in figure 10, two tides are formed upon it, as at *a* and *b*, one directly opposite the positive wire *p*, and the other 180 degrees from it, meanwhile there is an ebb in those regions which are situate a quadrant from the point of attraction. If the positive wire is made to revolve round the globule, both tides move, always keeping the same relative position to the point of attraction, that they had at first. It only requires the force of the battery to be appropriately moderated, to exhibit these phenomena with the utmost rigidness. And, as these motions exhibit very nearly, on a small scale, that effect which takes place on an immense scale, by the joint action of the Sun and Moon, in producing the tides of the ocean, I have given them the name of Tidal motions of Conductors, free to move.



13. Now the mechanism which produces the change of figures, from a sphere to an ellipsoid is sufficiently obvious. We have two forces under consideration. 1st. The cohesion or gravitation of the mercurial particles upon each other;—and, 2nd, the disturbing force of the polar wire, as a centre of attraction. As that disturbing force decreases in a certain ratio, as the distances increase, the mercurial particles on the side A, figure 11, nearest to the polar wire, are more attracted by it than those in the centre C of the globule, and those in the centre C, are more attracted than those at F. The particles, therefore, at A, rise towards the wire by its direct action, those at F, being less solicited towards the centre of the globule than those at E and B, the former recede from that centre, while the latter seek it.

11.



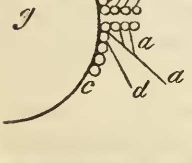
14. It has been observed, that a true theoretical tide differs in no respect from a wave. Suppose a spring tide actually formed on a fluid sphere, and the sun and moon then annihilated, the elevation must sink, pressing the under waters aside, and causing them to rise, where they were depressed. The motion will not stop, when the surface comes to a level, for the waters arrive at that position, with a motion continually accelerated. They, therefore, pass that position, as a pendulum passes the perpendicular, and will rise as far on the other side, forming a high water where it was low water, and low water where it was high water. And this would go on forever, oscillating in an assignable time, if it were not for the viscidity of the water. Now this theoretical case may be easily shown, for on approaching the positive wire towards the globule of mercury, a particular position will be gained, at which contact will take place, between the protuberant tide on the mercury and the wire. In that moment the cause of attraction is annihilated, the whole current of electricity now passes along perfect conduc-

tors, hence fulfilling the supposed case of an actual annihilation of the sun and moon, at the time of a spring tide. And the same reasoning that held in one case, equally applies in the other; the mercurial tide falls with an accelerated motion, and the line which before was the conjugate axis of the ellipse, now becomes the transverse; a tide being produced at right angles to the former one. But here the strict comparison ends, for as the mercury ebbs from its protuberant position, the metallic connexion breaks, and the wire is again put in action as a point of attraction,—the motion of the ebbing tide is checked,—it flows once more,—once more the metallic contact is complete, and when the tide falls,—it is only to flow again, as long as the battery current passes. Tides take place at right angles to each other, in a series too rapid to be counted, and the whole surface of the mercury is worked into those various and beautiful undulations which have been before referred to.

15. In endeavouring to ascertain the true cause of these phenomena, the French philosphers were, I believe, the first to observe these motions in the water, or other liquid of communication, as if a gentle wind played over its surface, bearing light bodies in its vortices. The explanation of these appearances, I here add, because no one as yet has given it, and it affords an illustration of certain propositions delivered by Sir I. Newton, in his principia, concerning thc doctrine of pulses in elastic fluids.

16. We have hitherto been considering a globule of mercury, as a substance mathematically fluid. Such, however, in effect it is not, the water in contact with it possesses those properties in a much more eminent degree, so that in comparison with it, the mercury may be regarded, as a solid resisting obstacle. Now about a year ago, I showed that when a voltaic current passes through a system such as this of mercury and water, the capillary pressure on the bounding surface is changed; but, if the attraction of the wire which is introduced into the water, and which is the ultimate cause of this dynamical derangement decreases in a duplicate ratio, it follows that this disturbance of pressure, obtains only to a limited extent on the surface of the mercury; or in other words, the excess of pressure produced by a voltaic current, is not spent equally on all parts of the mercurial surface, but those which are adjacent to the positive polar wire, are more affected than those at a distance. **Newton** has shown (Pr. v. 2, B. 2, pr. 41) that if the particles of a fluid do not lie in a right line, a pressure propagated through that fluid, will not be in rectilineal direction, but the particles that are obliquely posited, have a tendency to be urged out of their position. So the particles *a a a a*, figure 12, pressing on the particles *d b*, which stand obliquely to them, by reason of the shape of the mass of mercury *g*, have a tendency to be urged from their places towards *e* and *c* respectively, and the motion thus produced in a fluid, diverges from a rectilinear progress into the unmoved spaces, and such a pressure taking effect on a liquid free to move, continually return the moving particles, to their first position, after making them describe an elliptical orbit.

12.



17. It has been remarked, that the basis on which this explanation essentially rests, is that a wire, from which an electric current passes, acts still as a point of attraction; an effect which involves the conducting and other electric properties of the system, on which the experiment is traced. Hence we gain an insight into the cause of the paralysis of these motions, by the addition of certain substances,—the spiral motions going on the surface of

the water, have these explanations complicated with another consideration, —the figure of the mercurial mass.

Observations upon the facts recently presented by Professor Olmsted, in relation to Meteors seen on the 13*th of November*, 1834. *By* A. D. Bache, *Prof. Nat. Philos. and Chem. Univ. Penn.*

Before proceeding to examine the new facts recently put forth by my friend, Prof. Olmsted, in regard to meteors seen on the 12th and 13th of November, 1834, it will be well to state what is the difference of opinion between us.

Prof. Olmsted I understand to assert, that there was a recurrence of the meteoric display of November, 1833, in 1834, thus verifying a prediction made by him as a consequence of his peculiar theory. With that theory, further than as it is borne upon by facts in regard to the prediction founded upon it, I have not at present any concern. Independently of theory, it would be a very curious fact, if it were made out, that meteoric displays of an unusual kind occurred annually on the same night; and I was induced to observe on the night of the 12th–13th of November, 1834, with reference to facts rather than theory. Prof. Olmsted states his conclusions from observations made at New Haven, in these words: " On the morning of the 13th of November, 1834, there was a slight recurrence of the *meteoric shower* which presented so remarkable a spectacle on the corresponding morning of 1833."*

My views, as resulting, first, from observations made at Philadelphia on the morning of the 13th, are, that "there occurred on the 13th of November, 1834, no remarkable display of meteors of the kind witnessed in 1833." To sustain this, after recording the meteors seen by me on the 13th of November, 1834, I undertook to show, 1. That the meteors which I saw were neither in degree nor in their peculiarities like a portion of the meteoric phenomenon of November, 1833. 2. That they were similar, both in degree and kind,† to common meteors. The small number, and absence of a common radiant, support the first position. The nearness to the number frequently seen at a period of the night, and a period of the year when these meteors are less frequent than early in the morning and late in the autumn, together with the very different points in which their paths, if produced, would have intersected, show the second.

The new facts presented by my friend, Prof. Olmsted, and upon which I now proceed to remark, are classified by him as "foreign testimonies" and "domestic testimonies." The first are somewhat particular, but the latter quite general. The foreign testimonies alluded to, are those of the Rev. W. B. Clark, A. M. F. G. S., &c., and W. H. White, Esq., both of England. These gentlemen saw meteors on the morning of the 13th of November, 1834.

The opinion of Mr. Clark in relation to the meteors which he saw, is to be found in the same paragraph from which Prof. Olmsted has quoted his observations. It is thus expressed: "The coincidence between these and those seen in America and Europe on this day of the month, is curious, *but those which I now mention were electrical, and of no uncommon character.*[*] In a subsequent paper, after reviewing the observations made by Prof. Olmsted, Mr. Twining and myself, in America, and by Mr. White and himself in England, the Rev. Mr. Clark thus concludes:[†] "One fact is at least established by these seeming contradictions, viz. that *common electrical*[‡] meteors did appear both in America and England, on the same night, whilst there is no direct evidence to show that any others also appeared."

---

* Amer. Journ. Sci. vol. xxv. p. 363. Journ. Frank. Inst. vol. xvi. p. 368, in an article headed *Zodiacal Light*, between which and the meteors, Prof. Olmsted's theory leads him to infer a connexion.

† This term, which I used to denote the peculiarity in regard to the paths of the meteors, has, I find, been misunderstood. I did not mean to express by it an opinion that the meteors of 1833 had a physical cause different from that producing ordinary "shooting stars."

I have considered the opinion of Mr. Clark respecting what he saw, as the more important, because his description of the direction of the meteors is not very precise. He says they were in the direction of a line from Leo to the star Mizar. He may mean that their paths coincided with this line, or merely that they were parallel to it. Taking the former statement as most favourable to the similarity of this phenomena to that of 1833, it would still, however, be very different from that, however remarkable in itself. That fifteen meteors should fall precisely in the same line, is certainly a curious fact, but as certainly a very different one from the apparent convergence to a single point of the paths of more than 207,000 falling in very different parts of the heavens.

The Rev. Mr. Clark further states, that he saw one meteor which appeared to pass to the south of Ursa Major, and between Cor Caroli and Aucturus, the most northern of these stars being about seventeen degrees greater in north polar distance than Mizar. If this was one of the fifteen meteors before alluded to, Mr. Clark probably intended his description to apply to the general direction, and not to the precise position of their paths. This, however, is not important so far as the inference in regard to the question between Prof. Olmsted and myself is concerned.

The greatest number of meteors which Mr. Clark saw was fifteen in fifteen minutes, or else he only observed fifteen minutes; which is the correct supposition his account leaves doubtful. The portion of the heavens his view embraced is also doubtful: he merely states that he observed from a window. To make the hypothesis as favourable as possible to the number of meteors, we may suppose that he observed but for fifteen minutes, and saw fifteen meteors; that his range of vision embraced not more than one-tenth of the visible heavens, and that meteors fell in equal numbers over an equal space in other quarters. All these assumptions, and they are for the most part gratuitous, would make the number over the whole sky six hundred in one hour, while during the display in 1833, six hundred and fifty meteors[§] were counted in about one-fourth part of the sky in fifteen minutes, making upwards of 36,000 in one hour, and this only one hour and a quarter before sunrise.

The observations of Mr. White do not seem to me, any more than they do to Mr. Clark, to support the idea of a recurrence of the meteoric phenomenon of 1833. The number of meteors which he saw was ten in half an hour, being less than the number seen in fifteen minutes by Mr. Clark. The observations were made from windows which commanded a view of the north and east, and supposing that they commanded but one-sixth part of the heavens, and that the meteors were of the same frequency in every part, we should have one hundred and twenty meteors for the whole sky in one hour; one-three-hundredth part of the probable number visible in 1833, at Boston, in one hour. During the display of 1833, ninety-eight meteors were seen in fifteen minutes, the rate being three hundred and ninety-two per hour, within three-quarters of an hour of sunrise.

---

[*] Loudon's Mag. Nat. Hist, vol. vii. p. 655.
[†] Ibid. vol. viii. pp. 420, 421.
[‡] This term, electrical, is in allusion to his theory.
[§] Amer. Journ. Sci. vol. xxvi. p. 367

Neither does it appear that the meteors seen by Mr. White had an apparent radiant. One of the meteors of which he speaks, "glided almost perpendicularly towards the earth: this was succeeded by another of a most brilliant appearance,which took a westerly direction."

The ten meteors to which I have before referred, are said to have appeared between Leo, Virgo and Ursa Major. This place, as assigned in a general description, is a matter of course, since these were the principal constellations within view from the north and east windows from which Mr. White observed. Nothing is said about a radiant, too remarkable a fact to have been overlooked, had it existed.

But the number of these meteors has frequently been equalled, and even exceeded, in cases, between which and the meteors of 1833, no connexion has been claimed. I need only quote a few cases. On August 8th, 1823, Professor Brandes noticed sixty-five in two hours. On August 10th, "one hundred and fifty were noticed in less than two hours, and Professor Brandes remarks that they were obliged to leave many unrecorded."* During August, 1833, Mr. Espy and myself noted, over one-fifth of the visible heavens, thirty-seven meteors in one hour. We have noted eight in fifteen minutes, six in nine and a half minutes, five in ten minutes; and this at a time of the evening, and at a season when meteors are comparatively infrequent. At other times one meteor only would be seen in half an hour, showing the variable nature of the occurence, even on the commonest occasions. Prof. Olmsted himself refers to *showers* of meteors seen in *April*, 1833 in Virginia, in England on the *nineteenth* of *November*, in France in *April*, 1833, in August, 1833 in England, &c.

There is no connexion in point of time, between the English observations and those made in America. The meteors seen by both Mr. White and the Rev. Mr. Clark, occurred at a time when meteors were not frequent, even at New Haven.

The "American testimonies" given by Prof. Olmsted would determine the question if it were *did meteors occur on November 13th*, 1834; but upon the one really at issue they do not bear. The authorities, consisting of a member of the Theological Seminary at Andover, an anonymous writer in the St. Louis Observer, and a female servant at Zanesville, give no particulars on which to found an opinion as to the nature of the meteors which they saw. The St. Louis Observer merely states, loosely, that he saw, at five, A. M., in fifteen or twenty minutes, thirty or forty meteors. The accounts want the precision necessary to form any opinion in the case.

In regard to the remarks which my friend, Prof. Olmsted, appended to his facts, it is necessary to observe, first, that in addition to the indirect evidence of no meteoric displays having been seen at eleven military posts from Maine to Florida, six western posts, and five on the northern frontier, and which he notices, I presented other *indirect evidence*, not noticed by him, derived from scientific friends at Wilmington, Baltimore, the University of Virginia, and the University of North Carolina; and *direct evidence*, also unnoticed by him, from observations at New York, Philadelphia, and Nashville. Further, that a sentinel at Mackinac, where meteors *did* fall in considerable numbers, saw and remembered the fact. My friend states his preference for the testimony of nautical men, and yet of all those who navigated between this and England, on the night in question, not one has recorded observations of any extraordinary meteoric occurrence like that of the 13th of November, 1833.

---

* On shooting stars, by E. Loomis. Amer. Journ. Sci. vol. xxviii. p. 96.

In the second remark, allusion is made to a record on the minutes of the American Philosophical Society. This record* is there entered as a "verbal communication in relation to the result of observations on the recurrence of the remarkable meteoric display of November 13th, 1833." This record rests, not on the responsibility of that learned body, but on my own, and I believe I have shown full warrant for it. Records are made of all verbal communications presented to the Society, and among them will be found a reference to the new facts presented by my friend, Prof. Olmsted, as the substance of another verbal communication made by me.

In conclusion, I think the examination of those of the new facts which are susceptible of such a course, has conclusively shown that the meteors referred to in them were of ordinary character. And a comparison of this result with the inferences which I have elsewhere drawn from my own observations, and those of others, leads to the conclusion, that no satisfactory evidence has yet been presented of the occurrence, in 1834, of a meteoric display, which, in numbers, in peculiarities, or in connexion (as parts of the same phenomenon) and extent combined, was such as to connect it with the meteoric display of November 13th, 1833.

Bibliographical Notices.

The Book of Science. A familiar Introduction to the principles of Natural Philosophy, adapted to the comprehension of Young People. PART III. CHEMISTRY. [Philadelphia, Carey, Lea & Blanchard.]

The little work now before us is one of a series on Natural Philosophy. It has a merit which is rare in books of its class, that of accuracy. The preparation of elementary works is too often undertaken by the half learned in the subject of which they treat. Hence erroneous, partial, or inaccurate, views are sometimes instilled. It is a high distinction of our time, that men the most eminent in the different branches of science, have applied themselves to the preparation of popular works. The difficulty in such cases seems to be that few are able to come down sufficiently to the comprehension of the general reader. And few stand so high that their reputation may not be touched by treating a subject superficially. The class of works now referred to is however, a different one from that to which the subject of the present notice belongs.

Chemistry is a difficult subject to bring down to the comprehension of the young in a book: it requires experiments to illustrate, and frequent verbal explanations to relieve difficulties. A teacher who would take in hand the Chemistry of the Book of Science, and follow it in his experiments, and accompany it by his explanations, would do a good service to the youth under his charge, for the information is exact and such as he may rely on himself. It is besides generally brought up to the Chemistry of the day.

---

* This quotation from the minutes, which are not published, is made by permission of the Society.

If however the work should be placed in the hands of youth without such auxiliary aid, we doubt if they could at all comprehend it, or if they would be at all attracted by the science which it contains. Lively as some portions of it are, the general character is that of dryness. Hard words are not spared, and matters hard to be understood are unfolded. It would in fact, fully employ a teacher's thoughts, and he would be gratified with the task of expounding.

In schools where an elementary course of chemistry is taught by experiment and with verbal explanations, this work will, we are of opinion, be found useful. The typographical execution of the book is good, and the cuts though plain are generally illustrative. B.

The American Almanac and Repository of Useful Knowledge, for the year 1836. [Boston, Charles Bowen.]

This is the seventh volume of a very useful and creditable American work, containing a body of scientific and other useful matter, which must recommend it to very various classes of readers.

The astronomical department of the Almanac is as heretofore under the charge of Mr. R. T. Paine, one of the most zealous of our devotees to this branch of science. Besides the usual valuable matter requiring a yearly change, additions have been made to the tables of this branch, and a table of the moon's librations has been added. The table of longitudes has been corrected in several cases from observations either made or collected by the editor, and we have especially remarked, that the positions given to Charleston, Beaufort, (S. C.) and Savannah, differ considerably from those heretofore assigned. The arrangement of the tables which was made anew last year is continued, and if change of location were not objectionable in a book of reference, we should be disposed to prefer the new arrangement.

Of the astronomical phenomena predicted for 1836, the principal will be a solar eclipse to occur on the 15th of May. The general eclipse will first begin (at 5h. 58.4m. mean time at Washington) at a place in South America, the latitude of which is 2° 9′ S. and longitude 76° 51′ W., and end (at 10h. 48.4 mean time at Washington) at the place in the Mediterranean the latitude of which is 35° 11′ N. and longitude 28° 50′ E. The calculations of the general circumstances of this eclipse, and of the beginning, middle and end, &c., for seventeen places in or near the United States, with the approximate result for twenty-four others are given in the Almanac.

The second part of the Almanac, devoted to statistical and other information, contains papers on the statistics of crime in France, on Pauperism in France, on Agricultural and Rural economy, besides a mass of valuable statistical information relating to the United States and to the individual States, to religion and to education. The work contains a distinct head for meteorological information. It has indeed been reproached by a contemporary with containing too much matter, an objection not often to be urged to a work of so moderate a price, and one which needs only to be urged forcibly to induce a most extensive circulation. Such a circulation we heartily wish it may obtain. B.

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1835.

With Remarks and Exemplifications by the Editor.

1. For a *Thrashing Machine;* William Laighton, Portsmouth, Rockingham county, New Hampshire, June 6.

This patent is taken for an improvement on that of November 17th, 1834, described Vol. 15, p. 397. The claim now made is very similar to that in the original patent, and does not in any manner allude to new improvements; the patentee says, "the principles I claim as my invention, are the conical ribbed cylinder, and the semicircular ribbed cradle conforming thereto, by which, from the angular position with which they come into action, the hull of the grain is split without injury to the seed." As these *principles* made a part of the first patent, the claim cannot be sustained under the present one. or a man might renew his patent forever. The claim, to have been valid, should have pointed to those improvements only which the patentee has made since November 1834.

---

2. For an improvement in the *Theodolite;* Samuel Stone, Long Green, Baltimore county, Maryland, June 6.

The patentee states his improvement to be "in the art of measuring distances at one station with a theodolite, or any other instrument by which an angle can be made either perpendicularly or horizontally," &c. The patent, however, is taken for an improvement in the instrument, and not in the art of using it. He says, "the first improvement which I claim is the mechanical addition to the common theodolite, by extending the diameter of the horizontal limb for the purpose of forming a surface as well as a centre on which a circular rim or plate revolves, as already described; and also the application of the logarithmic calculations as applied to the circle, as already described. But I particularly claim the improvement of measuring distances by an angle at one point or station, using the pole or stave, with its graduations, for one side of the triangle."

With respect to its construction and use, the inventor says:

"This instrument embraces all the principles of a modern theodolite; besides which, it contains the following improvements: The first improvement is a circular revolving plate, sliding or resting upon the limb of the instrument, the upper surface of which forms a plane with the upper surface of the limb; on which are delineated a set of mathematical numbers, which supply the place of a table of logarithms, and all other logarithmic tables.

"In the second place, this instrument is so constructed as to supersede the necessity and use of a chain in all cases. The distance of any visible object can be ascertained at one station, as far as the flag staff can be distinctly seen through the telescope of the instrument, to the exactness of chains, links, and decimals.

"It also calculates the latitude and departure of every course run, and the base and perpendicular of all elevations. It further embraces all the fundamental rules of common arithmetic, viz: multiplication, division, single rule of three, interest, mensuration of superficies and solids, guaging, &c.

Any question in plain trigonometry, right angled or oblique, can be solved on the instrument correctly; including all questions that can be performed by logarithms or logarithmic tables. The whole without the use of figures or a mathematical calculation."

The instrument has received the approbation of the New York Institute, the managers of which have awarded their highest premium, a gold medal, to the inventor.

3. For *Extracting Gold from its Ores;* Nathaniel Bosworth, city of Philadelphia, June 6.

"The improvements herein described, for which a patent is asked, consists in the arrangements and connexions by which we are enabled to collect the particles as soon as disintegrated from the rock, thereby preventing their becoming armed with stoney matter as in the old process, which prevented the gold from coming in contact with the mercury. Also, by preventing the gold from parting with a portion of its substance in forming the streak upon rocks in contact during the operation of stamping, which has heretofore been a source of waste. By the old process the gold was necessarily stamped so fine as to flow over the top of the bocard with the water. By the new process the gold is carried out even with the bottom of the bocard, retaining its size and form as when in the matrix. Also the use of *silver or gold plate surface*, by which we obtain a new agent, that of mechanical pressure, in addition to chemical affinity. Should it not be convenient to obtain the precious metals for the amalgamating plates, and a substitute be used, such as brass, copper, tin or bismuth, it will be proper to subject the amalgam to the action of a single acid that will dissolve the baser metal and not the gold; for if tin, zinc or bismuth, or some of the other metals be combined with gold by melting, it then becomes extremely difficult to separate them."

"As other metals than gold and silver may be used, I claim not only their employment for the purpose described, but, generally, the amalgamating upon a hard fixed metallic substance of any kind, quickening the same by the smallest quantity of mercury which will answer the intended purpose of arresting the particles of gold in their passage over it, whereby I expose any required extent of quicksilvered surface, on which the gold will become firmly attached, or the particles effectually united."

Several drawings accompany the specification, and are referred to in it, affording a complete view of the apparatus.

4. For *Constructing Coffins of American or Hydraulic Cement;* Daniel Dayton, Hiram Hoyt and John White, Salina, Onondaga county, New York, June 6.

"This improvement or invention consists in making coffins of the American or hydraulic cement, and that improvement or invention is hereby desired to be patented."

We think that the making of a vessel or box in the form of a coffin, out of a material of which various vessels have been previously made, will neither be viewed as an invention or improvement in the eye of the law, nor do we perceive how such an *invention* could employ the powers of three individuals.

5. For an improvement in the *Truss for Hernia;* John L. Heintzelman, city of Philadelphia, June 6.

"Now all that I claim as my invention and improvement, and for which I ask letters patent, is the mode of placing the metal disk of the pad between the two sheets of caoutchouc, impressed and united as herein described and set forth, instead of placing it, as formerly, behind them, and dispensing with a covering of silk, leather, or any other substance whatsoever; thereby rendering the pad more elastic, more simple and durable, and perfectly easy to be cleansed without difficulty."

The caoutchouc pad is formed by pressing two sheets of caoutchouc, cut to a suitable size and shape, between heated metallic dies, by which the edges of the substance are united, and a proper form given to each side of the pad, the brass plate being enclosed between them, with a suitable tube projecting from the back of the pad, by which to attach it to the spring.

---

6. For a *Pyrimidal Stove;* Thomas M. Southwick, Troy, Rensselaer county, New York, June 6.

This is a sheet iron stove lined in the furnace part with soap stone. The only peculiarity which we see in it, is the forming of an air-tight chamber at the lower part, from which tubes are to ascend up into the furnace. The object proposed is to heat the lower part of the stove by the descent of heated air into the chamber; it will be found, however, that more heat would be conducted down by solid rods than by the air tubes: the contrivance is, in fact, at variance with well known principles.

"The invention claimed and desired to be secured by letters patent, consists in the arrangement and adaptation of the several parts of the stove so as to produce the one described; but I particularly claim the tubes which convey the heated air *downward* into the close vessel below for warming the feet, and the construction of the furnace containing the coal."

The description is very confused and indistinct, and the claim corresponds well with it.

---

7. For a *Machine for Mixing Mortar and Hoisting Brick;* Jesse Rinehart, Danville, Vermillion county, Illinois, June 6.

A horse power is to be used to turn a cylinder furnished with projecting pins, and revolving within a concave, into which the sand and lime are to fall from a hopper. As in the preceding patent the description is altogether defective. Nothing is said about the construction of the hoisting part; we are only told that "the mortar or brick is hoisted by the same power which makes the mortar, and much in the same way as other hoisting machines." The drawing represents several things not alluded to in the specification.

The claim is to "the arrangement and adaptation of the several parts of the machine so as to produce the one before described, for mixing mortar and hoisting materials combined.

---

8. For a *Machine for Hulling Clover Seed and Rice;* Winslow Braley and Jeremiah Walker, Phillips, Somerset county, Maine, June 6.

This machine consists of a grater or rubbing board, worked up and down by means of a lever, the seed descending between this and a stationary grater. The graters are made of punched sheet iron, fixed upon wooden cylindrical segments crossing the rubbing boards. The machine is well described, but there is no claim made, although it certainly possesses sufficient originality upon which to have founded one. Several parts referred to in the specification, have been omitted in the drawing; it is therefore defective, as it would not be a sufficient guide to a workman about to make the machine it represents.

9. For a *Thrashing Machine;* Hugh and Isaac W. Edgar, Wayne county, Ohio, June 6.

This is called a "Portable Grain Thrasher," but a horse power, which is certainly a separate and distinct machine, is also described in the same specification. The thrashing machine works by a cylinder and concave. and the general construction of the horse power is the same with many others.

"We claim, as our improvement, the peculiarly simple and substantial construction of the frame of the horse power and machine. The cheap and durable form of the master wheel; the proportionate shape of the bevil wheel, which gives it greater strength in proportion to the weight than the usual plan. The square pieces of iron with pins on the corners in ratchet joint, which are easier made, more substantial, and work with less friction at a great angle than those used heretofore. The form of the bar and bar tooth cylinder, the teeth of which are not liable to fly out by the centrifugal force of the cylinder when in motion. Placing wood or flat bars between the bars in the concave, which leave greater space for the grain. The regulating the concave to or from the cylinder with keys, to suit the state of the grain. The ratchet wheel shaft passing through the machine, so that the tumbling shaft may be attached to either end to suit different situations. Placing half the gearing on the machine, which reduces the motion of the tumbling shaft, and simplifies the horse power."

If the patentee can sustain all the foregoing claims, together with an exclusive right to his two machines, he will do more than we believe he can accomplish.

10. For a *Cooking Stove;* Elijah Skinner, Sandwich, Strafford county, New Hampshire, June 12.

This stove is to be set in a common open fireplace, and differs so little in its general arrangements from some others, as not to require or to admit of special description. The claim is to "the particular arrangement and effect of the flues, funnels, damper and oven, and the appendages for letting off the steam; and the application of the whole to the common open fireplace, as before described."

11. For an improvement in the *Common Fireplace;* Ira A. Bean and Elijah Skinner, Sandwich, Strafford county, New Hampshire, June 12.

A box is to be formed across the fireplace somewhat like a hollow iron back-log; below this box or furnace there is to be an air chamber, and a plate is to rise vertically near its back edge, so as, with the chimney back, to form a flue for the escape of smoke. In the top plate of the box there are openings for cooking utensils; there is an opening also for admitting fuel, and tubes to let heated air into the room, which, however, will never produce this effect, as the draught will be the other way. The claim is to "the construction of the box in the hearth, and the arrangement and application of the same, with the flues, funnels and false back, to common open fireplaces; the object of which is to save room and fuel, furnish a cheap and convenient apparatus for cooking, and at the same time avoid the impure air occasioned by close stoves, and the steam from cooking stoves."

The whole of the above named objects will not be attained by means of this contrivance; we do not think that there will be any special convenience in its use, and it certainly will not be economical when intended for heating in the place of a well constructed close stove.

---

12. For a *Thrashing Machine;* Thomas Rucker, Jr. of Murphreysborough, Rutherford county, Tennessee, assignee of Pendleton Check, of the same county, June 12.

In this machine there are two revolving cylinders, one placed over the other; the upper one is furnished with knives or cutters, acting against an opposing fixed cutting edge, and these together operate in the manner of shears. The grained ends of the sheaves are fed to this cutting apparatus, and the pieces cut off fall between a thrashing cylinder and a concave, grooved from end to end, in the form of saw teeth, by which the grain is thrashed out. The claim is to "the manner of separating the heads of wheat or other grain from the straw, previous to thrashing it by the combination of machinery herein specified and described." It is said that in this instrument "the wheat is thrashed out more completely, and with far less labour than in those machines where the whole sheaf is operated on."

---

13. For a *Plat-form Balance;* Alexander Bliss, Benson, Rutland county, Vermont, June 12.

"What I claim as my own invention, and not previously known in the above described machine is,

"*First,* The arrangement of the levers, by which they form parallel lines and right angles, in the construction of the machine.

"*Second,* The application of crank suspensions attached to the axle.

"*Third,* The described swing and its crank suspensions.

"*Fourth,* The employment of the swings in front and rear of the machine described in the specification, upon which the short arms of the upper levers rest."

Those acquainted with the platform balance will see from the foregoing, that there is nothing essentially differing from it in the action or construction of the machine proposed by this patentee. We are not aware that any advantage can result from arranging the levers all at right angles, and think that in this and some other points the change is in form rather than in substance.

---

14. For an improvement in *Bridges;* George Law, Easton, Northampton county, Pennsylvania, June 12.

The object proposed to be attained by the patentee is without lessening their strength, to give increased height to wooden bridges, thereby admitting of the passing of high loads, and of locomotives without lowering their chimneys. The framing of the bridge is to be the same as that now most commonly adopted, namely, double posts passing from one chord to the other with diagonal braces between them, thus forming a truss frame. The patentee says, "what I claim as my improvement and invention in the above described mode of construction, is limited to the additional stories, or tiers, of truss frames above the first or lower-most one, (which one has been used before.) I do not claim the principle of sloping the braces at right angle, nor the use of the arch, but simply the repetition or additional combination attained by adding tier upon tier as above described."

There certainly is but little, if any, invention in the foregoing plan; and, in most cases, the increasing the height of a bridge is objectionable from its greater exposure to injury by wind; independently of this consideration, we do not apprehend that any builder would find it difficult to increase the height of such structures without the fear of weakening them.

---

15. For a *Cheese Press;* David Phelps, Bangor, Penobscot county, Maine, June 12.

A windlass crosses the frame of the press, near to its bottom, the ends of the shaft passing through the cheeks so as to draw upon ropes, which are to communicate the pressure; a rope from each of these projecting ends is attached above to a bent, or progressive, lever, working upon suitable fulcra, and bearing at their inner ends against a follower, which they force up; they have friction rollers on their ends to enable them to operate freely. There is no claim made, although the patentee says that it "has advantages over all others in use, for reasons, which may be seen at a single view." This may be the case, but we do not think so, although we have no doubt that it will answer the purpose intended in all its parts; but in all its parts it is not new.

---

16. For an improvement in *Fireplaces for Grates to burn anthracite;* Joseph Snyder, Philadelphia county, Pennsylvania, June 12.

The greater part of this fireplace is proposed to be made of cast-iron; the bottom of it is formed of two parallel plates, two or three inches apart, and constituting a part of a circulating flue. This may stand upon feet, raising it a little from the ordinary hearth, and on it rests the back and jambs, the back also being formed of double plates, connecting with those at the bottom. The grate is situated as is usual in open fireplaces, and above it are double top plates also forming a flue between them. Hollow columns at the corner of this fireplace, in front, connect the hollow hearth with this hollow top, the back end of which passes into the chimney, in the manner of a Franklin stove; there is a damper situated on the lower plate of the upper base, which being opened allows of a direct draught into the chimney, but when closed, causes it to circulate around the whole structure. The grate is lined in the usual way, and supposing the damper to be closed, the draught is over the sloping back into the back flue, then downwards between the two back plates, then forward in the hollow hearth, and upward through the columns into the cap flue, and back into the chimney. The claim is to "the principle of diffusing the heat of an open fireplace or grate to the hearth and parts situated below the fire, by a descending and ascending flue, or flues, and double hearth, as set forth and described."

---

17. For an improvement in *Stoves;* John C. Parry, Pittsburgh, Pennsylvania, June 12.

Although many patents are taken for trifling things, the one before us may be considered as standing alone in its own littlenes. The whole thing proposed is to cover the rods used for connecting the tops and bottoms of Franklin, ten plate, and other stoves, by half columns of cast iron.

18. For a *Saw Set;* Herrick Aiken, Dracut, Middlesex county, Massachusetts, June 12.

The description of the saw set is very imperfect, or the instrument itself is strikingly so. There is to be a small piece of steel with a rounding face set in an iron bed, and upon this the setting is to be effected. Two horns, or projecting pieces on the bed, are employed to hold the said blade in its place, and there is to be a regulating guage, which in the drawing is represented as having teeth on it like those of a saw, and we are told that "the set of the teeth is performed by a hammer, or hammer and punch. The claim is to the foregoing parts." We know something about saws, saw sets, and saw setting, but should be at a loss, with all the helps before us, in attempting to construct and use the foregoing instrument.

19. For *Splitting and Paring Leather;* Herrick Aiken, Dracut, Middlesex county, Massachusetts, June 12.

This machine is for cutting or skiving leather after it has been cut in strips or pieces to the required length and width. Like the foregoing, it is but imperfectly described, and could not, therefore, be carried into effect without the aid of invention. A cutting knife is to enter horizontally along a cast iron frame, and what is called a *revolving regulator*, which we are told "is an inclined, hollow semicircle," is placed above the knife, extending between two upright studs, to which, we suppose, it is attached by gudgeons, placed eccentrically, so that when turned down over the edge of the knife, its distance therefrom may be regulated by its eccentricity, and thus serves as a guage for different thicknesses. There are some other parts for which we could suppose a use, and a mode of fixing, but this is rather a departure from our general design. Very simple instruments have been long in use for the same purpose, and although this is called an improvement, the term must be taken in its technical acception only, meaning that it is not precisely like those which have preceded it.

The claim made, is to "the arrangement and adaptation of the several parts of the machine so as to produce the one before described, and particularly the method of confining the knife, and the construction of the regulator." The former part of the claim may be tacked on to any specification; the latter portion is to things not properly described.

20. For an improvement in *Pumps and Fire Engines;* Henry Gates, Northampton, Hampshire county, Massachusetts, June 12.

The body of this pump is to be a short cylinder or drum, its axis standing horizontally, and truncated or cut off on its upper side so as to reduce it to about two-thirds of its cylindrical capacity; this upper part is covered, water tight, by a horizontal plate. An axis passes through the cylinder, and has attached to it two buckets or leaves, standing at right angles to each other, fitting the lower part of the cylinder and the two heads, water tight, to effect which they are made of durable metallic plates, screwed together with packing between them. Each of these leaves has a valve opening outwards, or towards the upper plate of the chamber.

The upper part of the drum is divided into two chambers by a fixed partition descending from the upper plate to the upper side of the vibrating axis, against which it is to fit water tight. There are two valves opening upwards on the top plate, one on each side of the partition, and these are both covered by a conical delivery pipe, by which the water is to be conducted as required. The receiving pipe descends from the bottom of the chamber into the resorvoir, or chamber.

The axis is to be made to vibrate about a quadrant of a circle, and those acquainted with hydraulics will see, that if the instrument be in good order, water will be raised by it. The construction of a pump, operating as described, is claimed. We could point to very similar plans of pumps, but we do not think it necessary to touch this point. Such pumps, if made with extreme care, will work promisingly at first, but they will soon go out of order. When in the best condition. we do not believe that such a pump is equal to the common piston and cylinder, the direction of the water being quite as much changed in it.

---

21. For *Heating Apparatus;* Robert Rogers, South Berwick, York, county, Maine, June 12.

This apparatus, we are informed, produces radiated heat, steam heat, and heated air at the same time, which are conjointly to be employed in the heating of buildings. The stove or furnace part may be said to consist of three concentric cylindrical vessels; the innermost of these is a circular pipe, like a stove pipe, which is to receive cold air at its lower end, below the ash pit; its upper end supplying lateral pipes with heated air at any convenient height above the fire chamber. This pipe, to the height of the fire chamber, is surrounded by a double cylindrical boiler which forms the inner wall of that chamber. The fire chamber is formed by a second double cylindrical boiler, placed at a proper distance from the former, and of the same height with it, and which is also the outer wall of the chamber, occupying the place of the ordinary lining of a cylinder stove; the grate bars and ash pit are formed as usual, and there are cold water and steam tubes leading into the boilers. The smoke pipe surrounds the air pipe, being reduced in its diameter by the conical form given to the stove above the fireplace.

The patentee believes that this stove will be very economical, producing a very large portion of heat from a small quantity of fuel, and as he does not point out any particular part of it as his invention, he appears to think that the whole arrangement is new; this, however, is a mistake, concentric cylindrical boilers forming the walls of the fire chamber having been repeatedly employed. Had we time to dwell upon it we could easily point out what we consider as great practical objections to the contrivance.

---

22. For an improved *Wind Mill for Raising Water* to set machinery in motion; David W. Hurst, Newbury, Essex county, Massachusetts, June 12.

How much the patentee is mistaken in his ideas and expectations as regards this contrivance, will be apparent from his own words; we therefore give what he himself says; a procedure the fairness of which he will not gainsay.

"This invention, it is believed, possesses advantages above all other machines now in use, inasmuch as with a small breeze of wind a crank placed at the upper part of a common windmill, will be set in motion. and being connected with machinery in the windmill, embracing four pumps or engines also connected, will raise from a pond, well, or spring of water, into a resorvoir placed in or near the mill, as may be convenient, a sufficient quantity to set in motion any variety of wheels and machinery required for grinding, and for all other purposes for which such machinery is used by cabinet makers, and in other manufactories, being conducted from the resorvoir on to an overshot wheel by common pipes; and possesses the important advantage of being set in motion by a slight breeze of wind, bringing into use the full power of the water upon machinery which may conveniently be placed under any building in which it may be required to be used."

The drawing represents a windmill working four force pumps to drive the mill wheel. If the thing was good for any thing it was not patentable, as the raising of water by windmills for various purposes is a very old invention; but the whole proposition shows an entire want of knowledge upon the subject.

23. For a *Mortising Machine;* Jonathan Page, Hennike, Merrimac county, New Hampshire.

There is, of necessity, a considerable resemblance among the various mortising machines which have been patented, their differences consisting in a more or less convenient mode of arraying the parts; all we shall give relating to that before us is the claim.

"Your petitioner claims the construction of the frame for receiving the piece to be mortised, with a movable *rest* and *guard*, different from any in use, whereby materials of different sizes may be more conveniently mortised, and wheel hubs, in particular, of all sizes, are mortised by the use of a cheap and simple carriage for confining them. He also claims the use of common chisels in the operation of his machine, and the cheap and simple construction of the whole."

24. For an *Oven;* Samuel Pollard, Bucksport, Hancock county, Maine, June 12.

A cylindrical sheet iron oven is to be placed in the chimney of a common open fireplace, its front resting on the iron mantel bar, and its back end being supported in any suitable way at the back of the chimney. An additional flue is to be made under the oven, just above the fire, to heat the back end of the oven more effectually. The contrivance has little or no novelty, and is very far inferior to some similar inventions. It may be put up cheaply, but that, alone, is not a sufficient recommendation. There is no claim made.

25. For a machine for *Shaving Staves, Heading, and Shingles;* John Everhart, Wayne, Warren county, Ohio, June 12.

This machine operates much in the same way with some others, that is, the stave or other article to be shaved is held down by a pressing roller, and is forced between cutting knives by means of a lever acted upon by a windlass. The claim made is "to the use of the lever geared as herein described, operating in combination with the knives and other part, in the manner, and for the purposes herein set forth." We think that there are certain parts of the machine which might have been specially claimed, in addition to the manner of acting upon the lever, and they might be more safely depended upon than the general action of the machine.

26. For a *Machine for Shelling and Grinding Corn;* George M. Weaver, Montgomery Square, Montgomery county, Pennsylvania, June 12.

The shelling is effected by means of a revolving cylinder, the corn being fed in by hand; the feeder, which reacts against the cylinder, has some peculiarities in its construction, but the whole machine does not essentially differ from some others. The grinder is merely a cast iron frustrum of a cone, furrowed on its smaller end, and on its edges, which revolves in a corresponding cast iron pan or box. The claim is to "the construction and arrangement of the feeder, operating with the cylinder, in the manner described; and also the construction of the grinder, by which it is made to grind on the conical and front surfaces at the same time."

---

27. For *Wooden Hames;* Sereno Norton, East Bloomfield, Ontario county, New York, June 12.

These hames are to be made of any hard close grained wood, and are to be formed much like the horse collar, for which they are to operate as a substitute. The mode of uniting them together by straps, and of attaching the gearing to them, with some other things relating thereto, are clearly enough described, and must be considered as altogether new in every part, as there is no claim.

---

28. For a *Spring Seat Riding Saddle;* Jacob G. Patmer, Harvey Beard and Anthony Beard, Greenville, Augusta county, Virginia, April 12.

Claim. "Now we do not claim as new in the construction of spring seat saddles, the application of a spring to the head of the tree, nor a spring of zig-zag or W shape, as applied to this purpose. But what we do claim as new, and our invention is the form and manner of constructing the frame and attaching the spring thereto, being curved so as to conform to the gullet of the saddle, and being attached to the tree by straps and webbing, as described. We also claim the application of similar springs to the girth, or girths of the saddle, and also the iron horn secured to and covered as herein described and set forth."

---

29. For a *Machine for Propelling Machinery by Weights;* Elisha Turner, North Pownal, Cumberland county, Maine, June 12.

We will present an extract from the so called specification, which, although aided by what is called a drawing, leaves the inquirer as completely ignorant of the intentions of the patentee, as though they were intended to be concealed. We guess, however, that the instrument is intended to *gain power*, although there is not even an attempt to make known how this is to be done.

"Operation. The weight being wound upon the loose barrel by manual or other power, the catch is thrown into the ratchet wheel by a spring made fast to the wheel fixed to the axle. The pinion on the end of the axle works into a cog wheel, this again into the cog wheels that convey the motion to any object required to be put in motion."

"The *invention* here claimed, and desired to be secured by Letters Patent, consists in the arrangement and adaptation of the several parts of the machine before described, for propelling machinery by weight.

---

30. For *Apparatus for Cooling Water and other Liquids;* John Waring, Port Tobacco, Carólina county, Virginia, June 12.

A vessel, like a jar, for containing water, is to be placed within a wooden box, and surmounted with *pulverized charcoal;* a second vessel containing ice is to be let down into the jar of water, and the latter when refrigerated, is to be drawn off by means of a cock.

A claim is made to "the arrangement and adaptation of the several parts of the apparatus for cooling water and other fluids." In which arrangement and adaptation there is neither improvement, invention, or discovery, if originality is considered as making a component part of these things.

31. For apparatus for *Hoisting and Delivering Burthens from Ships;* Barnabus Pike, city of New York, June 12.

A frame is to be made by connecting two stout pieces of timber, sixteen or twenty feet long, by cross timber mortised into their ends. The long timbers for a railway upon which to support a carriage, which runs upon friction rollers on their upper edges. Stout legs are framed into the lower sides of the rail timbers, the carriage has a block and tackle attached to it, by the aid of which, and a windlass, the goods are to be raised from the hold of a vessel. The carriage is then moved along the rails, which extend on to a wharf, and the packages landed. The claim is to the carriage as above described and applied, and the principle and mode of carrying and delivering the burthens."

The whole is clearly described and represented, and at certain periods we have no doubt that such an apparatus will be very useful, but the rise and fall of the tide must, in most places, very much interfere with the employment of it.

32. For *Antifriction Wheels;* Julian Nicolet, Pittsburg, Pennsylvania; an alien who has resided two years in the United States, June 12.

The wheel used is that of Mr. Ross Winan's, in which the axle, the friction of which is to be relieved, rests upon the inner periphery of a flanched friction wheel. The patentee says, "Now I do not claim to have invented the friction wheel described herein, but of its application to the specific purposes herein set forth," that is, to the shafts of water wheels, fly wheels, and paddle wheels, Mr. Winan's having applied them to rail road cars. Be it remarked however, that Mr. Winan's patent has not expired, nor has it been repealed, and the friction wheel itself, therefore, vests in him, and no one can take it from him under the pretence of applying it to axles of a kind differing from those to which he applied them.

33. For a *Bee House;* William Groves, Harrisburg, Dauphin county, Pennsylvania, June 12.

Houses, or large hives, for the more convenient management and security of bees, have been variously constructed by apiarians, several of which have been made the subject of patents. In that before us their are some variations of form and management, the absolute value of which is a question of experience, and as we perceive but little of originality, and have a long list to go through this month, we shall not give the claims or attempt any description.

34. For a machine for *Shaving and Jointing Shingles;* Samuel B. Chapman, Camden, Gloucester county, New Jersey. First patented March 15th, 1834, re-issued on an amended specification, June 12th, 1835.

Claim. "What I claim as my invention is the manner of fixing the knives within the iron frame; and the giving to one or both of them a vertical motion only, for the purpose, and in the manner, or upon the principle, herein set forth. I also claim the use of rollers, or segments of rollers, to continue the pressure upon the shingle after it has passed in part through the knives."

As this patent has been before noticed, it is not necessary to add any thing in this place to the claim now made.

---

35. For a *Winnowing Machine;* Jeremiah Nichols, Chestertown, Kent county, Maryland, June 15.

This winnowing machine is said to be like most others, excepting that leather is nailed on to prevent the escape of wind, and one or two other trifling additions made which we shall not take the trouble to describe.

---

36. For a *Mortising and Tenoning Machine;* Joseph H. Darby, Leominster, Worcester county, Massachusetts, June 15.

A very brief description is given of this machine, which is so similar to others that the *inventor* ought certainly to have pointed out its novelties; he, however, has failed to do this, and we have failed in the attempt to discover them; there is no claim to any part of the affair. A vertical shaft, capable of swivelling, when required, receives at its lower end, the chisel by which the mortises, or tenons, are to be made. A crank shaft, carrying a fly wheel, is to move the shaft up and down, and is itself made to revolve by means of a second crank, and a treadle. The stuff to be operated upon is placed upon a regulating shifting bed. The drawing shows two forms of chisels, but we do not hear any thing about them in the specification.

---

37. For a *Machine for Washing and Churning;* Charles Otis, Finksburg, Baltimore county, Maryland, June 15. (See Specification.)

---

38. For an *Auger;* William Jones, Portsmouth, Norfolk county, Virginia, June 15.

The specification of this invention is brevity itself exemplified; it consists of the following words. "This improvement is a hollow auger made so as to embrace the bolts or fastenings in ships or vessels, and to cut the wood from around them, by which means the plank, &c., can be removed, without the delay, trouble, and expense, usually required by splitting them out."

In the drawing, the augur is represented as twisted like the ordinary screw auger, but capable of allowing a bolt to pass within it. This must be a very useful thing, and, so far as we know, it is new.

---

39. For a *Paper Ruling Machine;* James C. Teasdale, Dansville, Livingston county, New York, June 15.

It is said in the claim that this invention "consists in having one additional cylinder, apron, and strings, by which the paper is ruled on both sides as before described;" which description fails altogether in its professed object, being drawn up without any apparent knowledge of the subject.

---

40. For a *Machine for cutting Sausage Meat, and stuffing Sausages;* Abraham and John Keagy, Franklin county, Pennsylvania, June 15. (See Specification.)

41. For an *Undershot Wheel;* Ebenezer Cochran, Gibson county, Indiana, June 15.

This is an old, and good-for-nothing contrivance. The buckets are all to swivel on pins near the periphery of the wheel, and we are told, and that not for the first time, that "A wheel thus constructed with floating and folding buckets, will run either wholly or partly under water without difficulty; and when the water has lost its force upon the buckets they will float and fold round on their pivots, with but little friction, weight, or obstruction, until they come on to the pins or cleats."

We could, with a little trouble, point to precisely the same thing; our remarks on the water wheel noticed at p. 236, vol. xi., apply sufficiently well, although the cases are not perfectly analogous.

---

42. For an *Accelerated Spinner;* Leonard Norcross, Dixfield, Oxford county, Maine, June 15.

A wheel of about a foot in diameter is to work into an endless screw, which takes the place of the ordinary whirl upon the spindle. It will be needless to contend against the novelty of this mode of obtaining rapid motion, and every one acquainted with machinery will be aware that rapid destruction will also be insured, from this excellent mode of increasing friction.

---

43. For *Raising Stumps, Rocks, &c.* from the ground; Leonard Norcross, Dixfield, Oxford county, Maine, June 15.

A tripod is to be made which is to be placed over the stump, &c. to be raised. A screw, standing vertically, passes through the cap of the tripod, and, at its lower end, has chains, hooks, &c. by which to hold on to the stump. A sweep, or lever, is to be drawn round by a horse, a nut on the inner end of the lever raising the screw; no provision is made to prevent the turning of the latter with the nuts.

We should think the claim just as legitimate to raise stones by a handspike, as to raise them, and other articles, by the most simple application of the screw. That such a machine properly braced, and upon firm ground, might be made to raise stumps, &c. there can be no doubt, but excepting the clearer of land can contrive to carry his stumps to the machine, he will find no small difficulty in carrying the machine from stump to stump, fixing it with sufficient stability, and obtaining a place for his horses to walk upon.

---

44. For *thinning Cotton Plants;* Jordan Gatling, Murfreesborough, Hertford county, North Carolina, June 19.

A kind of instrument resembling a double wheeled plough is so constructed as that the wheels may straddle the cotton rows. One of the wheels has cogs on its inner face which take into a pinion, or trundle, on a horizontal shaft, revolving lengthwise of the machine, and carrying two hoes, or one, as may be desired, on the ends of arms, for thinning the cotton; a coulter and horse hoe are fixed on to each side rail, for siding up. Some directions are given respecting the use of the machine when the cotton may be unequal in thickness; but upon the whole its action is not rendered clear. The claim is to "the manner in which I have combined the operation of the wheels and hoes in the interior of the frame."

45. For a *Machine for Thrashing Clover Seed;* John P. Ridings, Hillsborough, Highland county, Ohio, June 19.

In this hulling machine the seeds are to be rubbed between a cylinder and concave, and the fixing of the latter so as to be borne up by springs is all that is claimed. We apprehend that this claim has been before made, or the method of doing it described, at least ninety and nine times.

---

46. For an improvement in a *Forge and Bellows;* John C. Concklin, Peekskill, West Chester county, New York, June 19.

"The principle of this invention consists in the combination of a Smiths' forge, made of cast metal, with a double bellows placed underneath the bed of the forge; the bellows being of nearly the same dimensions in square, or horizontal measurement, as the bed of the forge. The forge, however, may be sustained on an iron frame work, so constructed as to be portable when the combination is made sufficiently light."

The middle board of the double bellows is to be placed obliquely, so that the movable boards may rise in reverse direction; this, we suppose is to save room. The forge back, bellows lever, &c., are described, but such forges, with the bellows beneath the fire, the greater part being made of cast-iron, are not novelties. We have one which was imported from England twenty years ago; and others very similar have been patented in the United States.

---

47. For a *Hinged Boot Cramp;* Nathan Ayer, St. Johnsbury, Caledonia county, Vermont, June 19.

Although hinged boot cramps are very common things, the patentee describes his, which he does with sufficient clearness, without making any claim. He merely informs us that "its peculiar utility and improvement is shown in its application to use. Having suitably blocked out the leather to be cramped, throw the leg and foot of the cramp, by means of the hinge, as near as may be in a straight line. fasten the leather around it in the proper place by slightly sewing the opposite edges, then raise the leg and latch it, insert the wedge at the toe; then by turning the screws on the bottom of the foot, at the heel and back, the leather to be cramped will be immediately compressed into the desired shape."

---

48. For *Xylographic Check Plates;* Charles C. Wright, City of New York, June 19.

The plate from which notes, or checks, are to be printed is to be covered, by means of an engraving lathe, by transferring, or otherwise, with a very light pattern, consisting of close, but fine, lines. From this the paper is to be printed, say of a light blue, pink, &c. The standing words may then be printed of another colour by any of the known methods. Should chemical means be resorted to for the removal of the fine ground, no human ingenuity, it is said, will suffice to restore and re-unite the lines; and to transfer the two kinds of printing lithographically, will be equally impracticable. When used without the printing of standing words, any erasure on the fine ground will be perfectly apparent.

"The invention consists in the prepared ground covering of paper to be used for securities written in whole or in part, with or without standing words in the same, of different colour from such ground, substantially as above described."

49. For a *Brick Machine;* T. Miles Bannister, Phelps, Ontario county, New York, June 19.

This is said to be an improvement on the machine called "Rising's Columbian Brick Maker," which, it seems, was a common pug mill for mixing the clay, the tub in which the vertical shaft, with its knives, revolved, being cylindrical.

"What I claim to have invented as an improvement on Rising's machine, is the tub or cylinder being larger at the bottom than at the top; the circular scrapers attached to the bottom of the shaft, the two pistons, and the manner of working them; the moulds, the manner of working them, and the mode of casting them off to right and left by means of a lever."

---

50. For *Pistons for Steam Engines;* Benjamin Wright and George Kitchen, Calhoun county, Michigan Territory, June 19.

This is a worthless contrivance, lamely described. The piston is to have six, or any other number of vertical rods extending from one head of it to the other, and between each of these there is to be a bellied friction roller, so as to form a circle of them fitting the cylinder, to take off friction. The other part of the piston is to be packed with hemp, or cork.

---

51. For a *Mortise Lock and Latch;* John G. Hotchkins, New Haven, Connecticut, June 19.

This is a kind of lock, or latch, somewhat similar to several which have been patented within a few years, excepting that before us is claimed to be new in the forming of the case and tumbler as described. To ascertain the peculiar difference between this and some others, would require more time than we can bestow upon the subject. The drawing does not make this point clear, for although it is good enough as a picture, it gives no sections, makes but three references, and that to parts partially obscured.

---

52. For an improved mode of *Fixing Tubes in Steam Boilers;* John Goulding, Boston, Massachusetts, June 19.

The tubes for the passage of heated air, or water, which pass from head to head, or from one part of a steam boiler to another, are to have tapering male screws cut on each end; one of these is to be larger in diameter than the other, so that the smaller screw at one end, and the tube also, may pass through the hole made for the larger screw. The larger end may be upset, or increased in size in any other way. The screws are to be tapering, and must be cut with such truth that they will enter and tighten up at the same time. The claim is to this mode of inserting tubes.

---

53. For a *Machine for Boarding and Softening Skins;* Eli Kendall, Ashby, Middlesex county, Massachusetts, June 19.

The mode of softening skins which has been hitherto followed, is to rub them with an instrument consisting of a board faced with cork, and having a strap across the back, in which to insert the hand. In the machine before us, there is a sort of rubbing board, the lower side of which acts upon the whole skin at once, it being doubled, with its polished side inwards. We cannot, without the drawing, give a full description of the machine, and it is not, in fact, very clearly illustrated. There is no claim made, the whole machine being considered as new. We are told that, by its means, one man can perform what has been accounted the work of three.

54. For a *Portable Boiler;* Anson W. Spenser, Cazenovia, Madison county, New York, June 19.

Boilers are generally made with the design of saving heat, but that before us is well adapted to the wasting of it, which it will do most effectually. The drawing represents a boiler something like a coffee pot, but with the smaller end downwards. An interior fire tube runs from bottom to top, perforating both, so that there may be an ash pit below, and that the draught may be increased by adding a pipe on the top. The fluid is, of course, to surround the fire. Of what use the thing is to be we are not told, nor will this soon be discovered.

55. For a *Machine for Cutting Grass;* Isaac Sturdevant, of Portland, and John Holmes, of Harrison, Cumberland county, Maine, June 19.

Four scythes are to be made to revolve horizontally on a vertical shaft, by gearing from the wheel axles. The general plan is one of the most common for such machines, is imperfectly described and drawn, and there is no claim made.

56. For a *Machine for Planting Cotton;* Jordan Gatling, Murfreesborough, Hertford county, North Carolina, June 19.

Machines for planting seeds are very numerous; the one before us consists of the various apparatus for opening the ground, dropping the seed, and closing the furrows, and differs but little from others. The claim is to that part of the machine which performs the operation of distributing the portions of seed intended to be dropped from the first hopper to the second, and consists of the combination formed by the slide board attached, as described, to the hopper and moved from side to side by the shaft suspended from the brace by the eye, and working with the slide board by means of the pivot, or pin: also, the use of the second hopper below, adjusted with the hole through the beam.

57. For a *Smut Mill;* John Card, Gainsville, Gennesee county, New York, June 20.

The patentee denominates this an "Elastic, Accelerating, Smut Mill," and furnishes a description of much length and particularity. A vertical shaft is to carry a cylindrical rubber, which may be two feet four inches high, fifteen inches diameter at top, and eighteen at bottom. This is to be surrounded by a stationary sheet iron case, punched from the outside so as to constitute it a concave rubber. The inner, or revolving, cylinder is also to be converted into a grater by covering the ends with punched sheet-iron, and the sides with strips of leather, into which nails, or tacks, are driven from the inside, so as to form a kind of elastic card. Instead of this, however, it is proposed sometimes to cover the outside with pointed cast-iron staves; the term "elastic" will, in this case, not very aptly apply.

"What I claim as my own invention, and not previously known, in the above described machine, is the manner of constructing the cylinder in the two different ways herein above specified, together with the principles of the operation of said machine, it requiring less power to propel it, and being used with greater safety, being less liable to generate heat, than any machine of the kind before known or used. I also claim as my invention, the manner of constructing the concave hereinbefore mentioned."

The machine is, substantially, so like a host of others that it would be no easy task to make out a claim which should not be too broad.

---

58. For a *Stove;* James Atwater, New Haven, Connecticut, June 20.

We are told by the patentee that "this improvement consists in certain alterations of, and additions to, a common furnace stove used to burn hard coal, for the purpose of retaining and diffusing the heat of the fuel burned therein in a convenient and economical manner."

Those who are acquainted with the construction of Spoor's parlour stove, (see vol. 16, p. 81,) will easily understand Mr. Atwater's, as it is precisely the same thing, changed only in form. The furnace part is the common cylindrical stove, with the four flues of Spoor's stove, forming four separate columns, the stove and columns extending from a quadrangular base containing the ash pit, and side flues, to a quadrangular cap, or entablature properly divided, and supplied with slides or dampers to cause the heat to circulate down the front and up the back columns, or to admit it directly to the escape pipe.

The patentee disclaims the invention of the individual parts, but claims as new "the above described combination and arrangement to accomplish the above mentioned purposes."

---

59. For a machine for *Mixing Mortar and Pulverizing Clay;* John Everhart, Waynesville, Ohio, and Lewis Swimley, Washington city, D. C., June 20.

We have before us, in Rees' Cyclopedia, a very perfect description of the machine here patented; it is there described as it was used seventy or eighty years since, but had then no claim to novelty, its construction and use being of remote antiquity. See the article *Pottery*, Rees' Cyclopedia, vol. 29.—We shall only copy enough from Rees, fully to supply the place of this *new* specification.

"The clay is thrown into a cylinder of cast metal, four feet high and twenty inches in diameter. In the middle of this cylinder runs a perpendicular shaft with knives as radii at right angles to the shaft. These knives are so arranged upon the shaft that their flat sides are in the plane of a spiral thread, so that by the revolution of the shaft the knives do not only cut every thing in their way, but constantly force downward what may be in the cylinder, agreeably to the nature of the screw; another set of knives is inserted in the interior of the cylinder, and extends to the shafts in the centre."

The only consolation we can offer to the patentees is that they are not alone in their disappointment, the same kind of machine having been repeatedly made the subject of a patent by other pretended, or imaginary, inventors.

---

60. For a machine for *Pressing Brick;* Wm. Wadsworth, Hartford, Connecticut, June 20.

This improvement is said to consist in a combination of machinery to effect a new purpose; the respective parts of which machinery may all have been individually used for the same or other purposes.

It is a toggle joint press, bearing a very considerable resemblance to other toggle joint presses, which have been employed for the same purpose.

We do not think that its new arrangements are so characteristic as to "distinguish it from all other things before known or used," without some specific pointing out of its novelties.

---

61. For a *Cooking Stove;* Le Grand Fairman, Medina, Orleans county, New York, June 26.

There is not any thing special in this stove, entitling it to particular notice. It is to have two ovens, one on each side, and any required number of openings in the top plate to receive cooking utensils, or dampers to direct and regulate the heat.

---

62. For *Portable Ovens, or Cooking Stoves;* Charles Vale, Newark, Essex county, New Jersey, June 26.

There appears to be but little novelty about this stove, excepting in the name given to it at the end of the claim, which is as follows: "The parts I claim as my invention, and not known, in the above portable ovens, are the particular construction of the fireplace, which only allows one-third of the fuel it will contain to be ignited at one time, and cause that to be regular as long as there is that quantity in it. The double shelves, and the manner of conducting the smoke and heat over the whole surface of them, by which so much fuel is saved, and from which I call it the *Chaloric* Extractor."

---

63. For a *Machine for Cutting Straw;* James M'Math, Meadtown, Crawford county, Pennsylvania, June 26.

"What I claim as my invention, and not previously known in the above described machine is the so affixing the knives to the gate, or slide, that they will follow each other at a distance just sufficient to allow the first to have passed through, or nearly through, the material to be cut, before this second comes in contact with it, and so on according to the number of knives used; and by giving a degree of length to the gate, or slide, and also of length to the lever, by one stroke of the lever the whole number of knives shall each in succession have passed through the straw."

It is calculated that by such a machine, four times the work may be performed, "with little, if any, additional power."

---

64. For a machine for *Felling Trees;* James Hamilton, city of New York, June 26.

The patentee, after describing the construction of his machine, says, "this applicant in the next place describes the principle of his invention, as follows. It consists of the combination of a horizontal saw with a crank movement, the saw being of any convenient length, but in the shape of a small segment of a circle, and the length of the crank with which it is directly connected being sufficient for the length of the intended stroke of the saw, the saw being fixed in a frame, and this moving in a centre fixed in another movable frame which is connected with and movable upon the same centre as that of the crank; this frame having a horizontal circular movement upon a roller, by force of a weight acting over a pulley, so as to bear the saw forcibly against the material to be sawed, the crank being made to act by any convenient mechanical motion, the whole operating so as to saw horizontally, it being designed for felling trees by sawing through the trunk of a tree horizontally, and near the ground."

Mechanical saws of this description have their uses, as for cutting off piles under water, &c., but they will never enter into competition with the axe of the American woodman; and we are well convinced that in an attempt to use them in this way, his aid would not unfrequently be required to extricate the saw from the kerf in which it would become pinched.

---

65. For a *Corn Shelling machine;* John C. Dunbar, Temple, Kennebec county, and Addison Powers, Carthage, Oxford county, Maine, June 26.

This is the most old fashioned, because it is the first fashion, of shelling machines, but the patentees propose to make the concave of three separate pieces of sheet-iron, and to perforate them like a grate.

---

66. For a *Cooking Stove;* Thomas D. Burrell, Geneva, Ontario county, New York, June 26.

In the description of this Cooking Stove there are several things mentioned which are omitted in the drawing; such, for example, as openings for kettles, doors, &c. &c. The lower part of the stove, which is to contain the fuel, is represented in the form of a very low Franklin. The two upper plates of this, making part of the flues, extend far back, and from them two other plates run vertically to the height of two feet, forming a semicylindrical flue, eighteen inches in diameter within. The upper end of this also is double, and from it rises the smoke pipe.

A semicircular tin reflector is to be placed against this semicircular recess, and converts it into an oven, eighteen inches in diameter, and two feet in height. A vertical shaft within this, furnished with open, horizontal shelves, called a revolving reel, is to sustain the articles to be baked.

The claim is to "the oven formed by the flattened upright flue and covering; the upright revolving reel, and the combination of the door and openings in front, for the uses set forth." Which latter part, with its combination, we are left to guess at, it being entirely omitted in the drawing.

---

67. For a *Napping Machine;* Reuben Daniels, Woodstock, Windsor county, Vermont, June 26.

This machine is intended for the narrow kinds of cloth. The napping cylinder is made about nine inches and a quarter in diameter, and about three feet in length. The surface consists of twenty-six lags, or strips, allowing a space between each for needles to pass in and out. The napping cylinder is hollow, and has a cylindrical shaft through its centre, upon which is fitted the necessary apparatus for projecting or retracting the needle points. This apparatus is governed by screws at the end of the cylinders. The needles are fixed on metallic plates very near together, so as to stand like the teeth of a comb. This cylinder may be so placed as to operate like the ordinary teazling machine, but its motion must be much slower.

What is claimed "is the principle, or improvement of varying, gauging, or graduating, the projection of the needles, wires or teeth, which are designed to do the work, performed by teazles in the common teazling machine."

---

68. For a *Rotary Steam Engine;* Orson Baines, Van Buren, Onondaga county, New York, June 26.

This is another machine to blow away steam to little good purpose. A hollow gudgeon is to carry steam into a hollow revolving drum from two points on the edge of which it is to escape.

"Now what I claim as my own invention and not previously known, in the above described machine, is the discharging of the steam on the outside of the rim of a tight enclosed circular wheel, at the greatest possible distance from the axis, or shaft, by which an increase of power is gained over any other rotary engine," &c. &c.

69. For improvements in the *Loom for Figured Work;* E. Meily, jr. and J. & S. Mellinger, Lebanon, Lebanon county, Pennsylvania: first patented March 1st, 1834. Reissued under an amended specification, June 26.

The description and drawing of this machine under which the first patent was issued, were altogether defective, and although it has been intended to remedy these defects by the amended specification and drawing, the latter are so constantly, and necessarily, referred to in the former, as to render them inseparable. We think the improvements valuable for the purposes to which they are applied; but all that we can now do towards giving an idea of them is to insert the claim, however inadequate this may be.

"We claim as our invention the general arrangement of the parts connected with the round and oval wheels, as herein described, for the purpose of operating upon the needle shaft in the manner and for the purposes set forth. We claim this manner of carrying out the pattern cards by means of friction rollers, and the steadying the same by means of a loose roller in the doubling thereof. We also claim the mode described of preparing the pattern cards upon a block of wood, by means of a hollow punch and clearer, operated upon by a spring."

70. For *Riding Saddles;* A. L. Van Horn, City of Philadelphia, June 26. (See Specification.)

71. For a *Machine for Hulling Clover Seed;* John Whiteman, City of Philadelphia, June 26.

The seed to be hulled is put into a hopper which narrows down so as to leave a longitudinal opening through which the feeding is affected by means of a fluted revolving roller. The hulling is effected by means of revolving, metallic disks, or wheels, five or six inches in diameter, fluted, or grooved, at each side and on the edges. These are placed upon two shafts, standing in the same horizontal plane, the disks on one shaft standing between those on the other, and just clearing each other and the shaft, so as to admit the seeds to pass without being crushed. Any number of disks, of which the size of the machine admits, may be placed on each shaft. The disks revolve towards each other, and the feeding takes place in the centre between them. A comb-shaped board on each side prevents the seed from escaping outside of the disks.

The claim is to a machine so arranged and constructed as that a new hulling machine is thereby formed.

72. For a *Rotary Steam Engine;* Charles Hill, Zanesville, Muskingum county, Ohio, June 26.

To understand the whole of the references made in the claim would require a drawing, and as our confidence in the Rotary Steam Engine is small, and our objections will yield to the omnipotence of success only, we wait the arrival of such a proof. This is one of the reaction engines, and the claim is to "the principle of increasing the surface of reaction, and diminishing the motion, without diminishing the power of the steam; which is effected by the enlargement of the steam pipes, (as at D, D,) and the vacuum created by the condensation of the steam, giving a less velocity to the wheel, accompanied by a corresponding increase of power. I also claim as my invention the introduction of water and air, either separately or in connexion, for the purpose of creating the vacuum, and the manner of introducing and disposing of the same; together with the manner of disposing of the steam so as to assist in maintaining the vacuum. I claim as my invention the application of these principles, to attain the objects herein set forth, whether the same be effected in the precise manner described, or otherwise."

---

73. For *Ever Pointed Pencil Cases;* Ellwood Mears, City of Philadelphia, June 26.

The improvement consists in the manner of forcing the lead out of the metal point, and is as follows. The slide, or band, which moves up and down the stick, is also capable of a circular motion around it. This slide, or band, has on its inner surface a screw thread, into which the nut of the pin, or wire, used in propelling the lead from the point, works. The band or slide is kept in its place, and pushes out this metallic point by means of two small screws fastened to the lead groove within the case, and rising on each end of the band. Thus by holding the case in one hand and turning the slide or band to the left, or, if preferred, by retaining the slide so as to be immovable, and turning the case to the right, the lead can easily and quickly be propelled from the metallic point.

"What I claim as my own invention, is the method of using the band, or slide in forcing the lead out of the metal point, instead of the complicated works heretofore in use."

---

74. For a *Churn;* Isaac Wood, Connelsville, Fayette county, Indiana, June 26.

There is an oval tub, through the sides of which a shaft is to pass, having a winch at one end by which it may be turned. The shaft must revolve in a water tight joint, and is to carry a number of arms or dashers, of such length as the tub will admit.

There is not any claim made, and, excepting in the shape of the tub, which does not offer any very apparent advantages, there is scarcely any difference between this churn and many others.

---

75. For a *Mill for Grain, &c.;* William S. Johnson, City of New York, June 26.

The patentee calls this an "eccentric mill," and proposes it as proper for grinding paints, dye stuffs, snuff, and most other articles required to be ground. A sufficient description of it may be found at p. 34, Vol. 10, as patented by James Bogardus, of the City of New York, the difference between that and the one now before us being, most manifestly, colorable only. We should think it certain that if the claim of Mr. Bogardus was well founded, the present is an invasion of it.

---

76. For a *Machine for Planting Corn;* Thomas D. Burrall, Geneva, Ontario County, New York, June 26.

After describing this seeding machine the patentee very truly says, "now in the above description there is perhaps no one part which is new in itself;"

and to this he adds: "But what I claim as my invention is the combination of the several parts above described, forming collectively a convenient and useful implement for furrowing, planting, covering, and rolling, at a single operation."

This sort of claim, to combination and arrangement, has become a kind of universal salvo where nothing new is to be found in the machine patented, but it will not answer; where there is real novelty in an invention, and it consists, as is most commonly the case, in combination and arrangement, it is as susceptible of being distinctly pointed out as novelty of any other sort: in the case before us, it is true, the task would have been a hard one.

---

77. For an improvement in *Roofing Houses with Tin, Copper, and Zinc;* John Bouis, Baltimore, Maryland, June 26.

This improvement is very imperfectly described; the apparatus used for bending the edges of the plates is not well represented, nor is any thing particularly pointed out as forming the foundation of a claim. All that we can collect of any peculiarity is that "the grooves or edges of the groove roofing being made in a semicircular form, instead of an angle as formerly constructed, give the metal a better chance to expand or contract without the danger of cracking, and also form a gutter to carry off the water and dirt, without obstruction." There are no instructions given for fastening the roofing; we conclude, therefore, that there is not any thing new in this.

---

78. For *Flasks for Moulding Iron Tea-kettles;* David Stewart, Danville, Columbia County, Pennsylvania, June 26. (See Specification.)

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for an improvement in Riding Saddles. Granted to A. L. VAN HORN, *City of Philadelphia, June 26th,* 1835.

To all whom it may concern, be it known, that I, A. L. Van Horn, of the City of Philadelphia, have invented an improvement in the manner of making Riding Saddles of all descriptions, and that the following is a full and exact description thereof.

The saddle need not in its general construction be in any way altered from that now pursued by the manufacturers of that article. The saddle tree, the irons, the mode of covering, and in fact all the parts may be the same with those now employed by different workmen, my improvements consisting solely in the substituting webbing, or girth, of the kind denominated India Rubber Webbing, for that which is usually strained upon the saddle tree, and which forms the foundation for the seat. The India Rubber Webbing is a well known article, consisting in part of that substance interwoven with the ordinary materials of webbing, and communicating to it great elasticity, and that in a degree peculiarly adapting it to the new purpose to which I have applied it. In order to derive all the advantage possible from the use of this webbing, I take care in straining it to draw it as high upon the cantle as possible, as by this means it will have sufficient play without descending so low as to come in contact with the back of the horse, or with the saddle tree.

A. L. VAN HORN.

Specification of a Patent for an Improvement in Flasks for Moulding Iron Tea Kettles, and other vessels of a similar nature. Granted to David Stewart, *Danville, Columbia County, Pennsylvania, June* 26*th*, 1835.

To all whom it may concern, be it known, that I, David Stewart, of Danville, in the County of Columbia, and State of Pennsylvania, have invented an improved mode of constructing Flasks for the moulding of Cast Iron Tea Kettles, by which the number of parts of which they ordinarily consist is reduced from four to two, and the necessity of turning the flask over in the operation of moulding is altogether obviated, and I do hereby declare that the following is a full and exact description thereof.

I use a mould board of cast iron, upon which the pattern and flask are to be placed. The mould board has a circular excavation, or gutter, around its centre, which is to be filled with casting sand, upon which that part of the pattern rests which forms the rim, of the opening in the top of the kettle, which part would otherwise be chilled by the mould board in casting. The pattern for the kettle is in the usual form, and has a square shank rising from the centre of that part which forms the opening for the lid, which shank fits into a square hole in the centre of the iron mould board, when the pattern is placed upon it for moulding.

The flask consists of two parts only, dividing horizontally immediately opposite the swell of the kettle, and the upper part extending a sufficient height above the bottom of the kettle for the requisite thickness of sand. The pattern being put into its proper place is surrounded by the lower half of the flask, and this is filled with the sand to a level; the upper half of the flask is then placed on, and the moulding of the outside completed, when the upper flask may be taken off, and the pattern removed. The manner of moulding the spout does not differ from that ordinarily pursued.

The mould for making the core, and the manner of filling it differs from that heretofore followed, the core mould being filled from the part which forms the bottom, instead of that which forms the top of the kettle. A mould board is prepared having a hole in its centre of the same size with that in the iron mould board, and into this the shank of the anchor, which is to sustain the core, is placed, and that half of the mould which corresponds with the top of the kettle is passed over it, and secured in its place. The other half of the core mould is then put on, and the whole is filled with sand, properly rammed in. In order to fill it, the core mould has a suitable opening, or openings in the part which is uppermost, and which corresponds with the bottom of the kettle, and when this is properly filled, and the core pierced for air holes, it is ready to be removed to the iron mould board, and anchored in its proper place.

What I claim as my invention, and wish to secure by letters patent, is the particular manner of constructing the flasks as described, in two parts only, for the moulding of tea kettles, and other articles of a similar form; the employment of the iron mould board; and the formation of the core in a separate box, or pattern, charged with sand at the bottom, and adapted in the way described to the anchor, which is to be placed on the mould board without the necessity of inverting, or being obliged in any way to raise or remove the same, in the operation of moulding. I also claim the application of the same principles of moulding to all kinds of hollow ware, which is swelled, or bellied, in the manner of tea kettles, varying the procedure in such a way as will be evident to every competent workman, so as to adapt it to the particular kind of vessel intended to be cast.

David Stewart.

Specification of a Patent for an improved machine for the purpose of Cutting Sausage Meat, and of Stuffing Sausages. Granted to ABRAHAM KEAGY, *of Bradford County, and* JOHN KEAGY, *of Franklin County, Pennsylvania, June 15th*, 1835.

The cutting is effected by means of a cylinder, around which are placed knives which we usually make of a triangular form, one of the sides being in contact with the cylinder. This revolves within a concave, or hollow cylinder, furnished with similar knives so placed as not to interfere with those on the cylinder. These knives are but placed somewhat obliquely, so as to stand in the direction of a spiral around the cylinders. The revolving cylinder has its axis placed horizontally in a box, the sides and ends of which are enclosed excepting where the meat is admitted and discharged. A gudgeon projects through the box at one end to receive a crank or wheel to turn the cylinder.

The opening for feeding is on the upper side, and at one end of this box; and this opening is surmounted by a vertical trunk, which may be in the form of a parallelogram, of the width of the lower box, and about half its depth, more or less. A piston, or follower, is adapted to this feeding trunk, or hopper, from the middle of which a rod rises, operating as a piston rod, being acted upon by a lever, worked like a pump handle. The piston rod passes through the lever, and has a rack, or notches, upon it, which engage with the lever in its descent, but allow it to rise without raising the piston, so that the meat put into the feeding trunk is forced down by each successive stroke. To facilitate the passage of the meat into the horizontal, from the vertical trunk, I form a spiral excavation in the hollow cylinder, immediately under the vertical trunk; which operates as an inclined plane in producing the desired effect. The cut meat, when it arrives at the extreme end of the cutting cylinder passes out through an opening in the bottom of the box. When the feeding trunk is to be replenished, the lever may be turned back on its joint, and the piston removed, leaving the opening perfectly free.

When the cutting has been completed, the vertical trunk, with its piston, is used for the purpose of stuffing. To effect this, a shutter, or slider, is slipped into its place where it forms a bottom to the vertical, and cuts off its communication with the horizontal, trunk, and a tin, or other tube, of proper size, is fitted into an opening prepared for it on one side of the trunk, at its lower end, upon this tube the entrail to be stuffed is gathered, in the usual way.

To allow the escape of air, this latter tube has a small tube, or opening, soldered on its outside, from end to end. This opening may be semicircular, so as to make but a slight projection on the stuffing tube. The effect of this will be obvious.

We have not thought it requisite to give the dimensions of the respective parts, as they will vary according to convenience, and will depend upon the power to be applied, and the quantity to be cut. One thing, however is essential, namely, that the length and size of the cylinders, and the number of knives, be proportioned to the quantity to be cut; but this can be regulated also by the pressure made upon the piston.

We do not claim as our invention, the individual parts of the above described apparatus, but what we do claim is the general combination and arrangement of the respective parts, as herein set forth, for producing the required effect. Not intending, however, to confine ourselves to the exact form given, but to vary the same in any way, whilst the same results are produced by analogous means.

ABRAHAM KEAGY,
JOHN KEAGY.

Specification of a Patent for Washing Clothes, and for Churning. Granted to Charles Otis, *of Finksburg, in the County of Baltimore, and State of Maryland, June 15th,* 1835.

I make a revolving cylinder, or barrel, which is to turn upon gudgeons in the usual way, and having an opening through which the articles to be acted upon may be introduced, and secured by a close fitting door, or shutter. I cause this barrel, or cylinder, to revolve in a trough which serves to catch any suds that may be allowed to escape, and which, in the churning of butter may be filled with water, either warm or cold, according to the season of the year, and thus facilitate the operation. The parts thus far described I do not claim as constituting any part of my invention, the same having been repeatedly constructed by others; but what I do claim is the following appendage within the revolving cylinders. I place flat wings, or buckets, on the inside of the periphery of the cylinder, extending along from end to end; of these there may be two, three, or more, made of flat boards, the planes of which stand in the direction of radii to the cylinder. These boards may vary in width from two to six inches, more or less, according to the size of the machine, and I sometimes perforate them with holes, to increase the agitation of the fluid. They also serve to lift the clothes and suds in washing, or the cream in churning, more effectually than the pins which have sometimes been employed for that purpose. I confine my claim exclusively to the employment of the wings, or buckets, herein described. C. Otis.

Progress of Theoretical and Practical Mechanics.

Report on the use of the Hot Air Blast in iron Furnaces and Foundries. By A. Guenyveau, *Engineer and Professor in the Royal School of Mines.*[*]

(Translated for this Journal, by Professor A. D. Bache.[†])

This report embraces the observations made during a tour of examination of the furnaces and foundries in the south of France, in some of which the hot air blast is used. The tour was undertaken by order of the director-general of bridges and roads, and of mines.

In remarks upon the subject, a distinction must be made between the furnaces where coal is used and those which use charcoal. The amount of air required is so different in the two classes, being sometimes as two or three to one, that the apparatus for heating it is usually different. The results are, however, nearly the same for both classes. All the furnaces examined use ores from the same part of France. The hot air blast has succeeded best in the furnaces of Vienne (Isere), the two at Terre-Noire (near St. Etienne), and those of the Voulte (Ardeche.)

In one furnace, that of Firmy (Aveyron), the results with this blast were not satisfactory, either with raw coal or with coke. The large establishments of Creusot and Alais, and those of l'Orme (Loire), have not yet applied heated air. The fuel used in them is coke. At the furnace near Torteron, where the fuel is a mixture of charcoal and coke, the hot air blast has been used to advantage, in regard to the quality of the iron. In the various smelting furnaces in Burgundy and Franche-Comté, where charcoal is used as a fuel, the new process has proved satisfactory.

---

[*] Annales des Mines, vol. vii. Livraison 1.

[†] This is a translation of extracts from the report of M. Guenyveau, and in parts where the details do not seem to be of special interest, an abstract of his results.

I. Heating Apparatus.

Of these there are various forms in use. The objects sought are economy in heating the air, a sufficiently high temperature, and the preservation of the pipes. The apparatus used at Calder* (Scotland) appears to answer the best purpose. It is in use at Vienne, and in one of the Firmy furnaces. The first apparatus put up was like that used at the Clyde† furnaces; this is still used at Torteron and la Voulte, but has, at Vienne, given place to the Calder apparatus. The heating pipes are two inches in diameter, and at Firmy have been replaced by others two and a half inches in diameter. It might seem that these pipes are too small, but experience has sanctioned their use. It is not known how long this apparatus will last; in fact the duration must depend upon the temperature to which the pipes are heated, and upon the nature of the coal. It is believed that the arrangement with highly inclined tubes will outlast that with horizontal ones. The temperature of the air is easily raised above the melting point of lead (604° Fahr.) The cost of the apparatus for each tuyere is about 1200 francs ($240.)

The flame which appears at the trunnel head of smelting furnaces which use coke, has not been applied to heat the blast, although it has been advantageously applied in charcoal furnaces. It would seem that this mode of heating should apply particularly to furnaces in which raw coal is used, on account of the amount of unconsumed combustible matter which issues from the trunnel head; notwithstanding which, M. Dufrenoy gives one case, in the neighbourhood of Birmingham,‡ in which the heating apparatus placed upon the platform of the furnace did not answer the purpose. The temperature of the air could not be raised above 360° Fahr., and subsequently it was heated by a separate furnace which consumed four tons of coal for each ton of iron. As, however, the temperature to which the air is heated at the Voulte furnace is below that just stated, the question cannot be considered as decided.

The air blast is generally heated above melting point of tin (442° Fahr.), and sometimes above that of lead (604° Fahr.), and even higher. In other furnaces, as at the Voulte and Torteron, where horizontal heating pipes are used, the temperature has been diminished, in order to save the wear of the pipes. At the first mentioned furnace it never exceeds 340° Fahr., being at a mean about 320°, and at the second never exceeds the melting point of tin. At the furnaces of Terre-Noire the heat is carried by Taylor's§ apparatus to 572° Fahr. It has been said that the advantages of the hot air blast increase in the ratio of the temperature of the blast, an assertion which, although it appears probable, and has been confirmed by certain observations, is not true in all cases. At the Voulte the results were sensibly the same where the air was heated to 428° and to 320°.‖

Several methods have been used to determine the temperature of the hot air blast. One was to use a common thermometer, with a metal scale; the bulb being inserted into the blast pipe near the nozzle. Another method was to use a slip of lead, tin, or of some fusible alloy, according to the temperature, which was exposed to the air issuing from a hole in the blast pipe.* At Torteron the alloy was two-thirds tin to one-third of lead.

---

* See this Journal, vol. xv. p. 213, pl. 2, figs. 6, 7, 8 and 9.

† Ibid. vol. xv. p. 209, pl. 2, figs. 1 and 2.

‡ See this Journal, vol. xv. p. 272, pl. 3, figs. 15 and 16.

§ Similar to that described by M. Dufrenoy, vol. xv. p. 213.

‖ It may readily be understood why an increase of 100° from 320° to 420° should not produce so sensible an effect as from 220° to 320°, or as from 120° to 220°.—Translator.

Great inconvenience has been felt from the leakage of the pipes used in the heating apparatus. These leaks when they occur in the heating ovens are only discovered by a deficiency in the yield of the furnace. They occur commonly at the joints, and the liability to them increases with the increased temperature of the blast. The repairs which are necessary alter the supply of air, and thus derange the system of working.

It is a desideratum to render the leakage less common and the means of repair more easy. When these leaks occur, if the fire is not immediately extinguished, the pipes being no longer kept cool by the air passing through them, burn out very quickly. The heating apparatus placed near the trunnel head is free from this defect.†

The effect of these difficulties has merely been to produce a resort to the reduction of temperature noticed at the furnaces of La Voulte and Torteron. The remarks of M. Dufrenoy on the forms of apparatus, confirmed as they are by extensive observation, deserve great attention.

The effects of heating the air upon the quantity and pressure of that passed into the furnace may be thus estimated. If we suppose the air heated from 60° to 568° Fahr. its bulk will be doubled and consequently, under the same pressure, but half the quantity will pass through a given orifice, which would have passed had the air not been heated. Generally, until the area or nozzle of the blast pipe is nearly doubled, the advantage of the hot air blast is not realized. Before this change in the nozzle, the furnace is not duly supplied with air. Besides, the pressure at the tuyere has been observed to diminish with a given pressure at the blowing machine, a fact which may be explained by the resistance of the air moving through the pipes of the heating apparatus, the elbows in which tend to make the resistance quite considerable in amount.

If then the pressure and the quantity of air thrown into the furnace should be the same with the hot and cold blast, the power of the blowing machine must be increased. This has not been found necessary in the English works, where on the contrary they have supplied more furnaces with heated air by the same blowing machine, than could be supplied with cold air. Less fuel being consumed in a given time, with a greater yield of metal, less air is required to support the combustion. In these works the power required to supply heated air is estimated at one-tenth more than that employed for the cold blast, for the same weight of ore, but as the weight of the air thrown in is diminished one-fourth, the same blowing machine which supplied three furnaces with cold air will supply four with the hot blast.

At the Calder furnaces (Scotland,) the pressure of the hot air blast was less than that of the cold air previously used by two-thirteenths, and at the Clyde works by one-sixth. M. Varin estimates the economy from this source at la Voulte works at one-fifth, the pressure being reduced from three inches and a quarter of mercury to two inches and a half.

At the Torteron furnace where the heated air blast has neither changed sensibly the amount of fuel used, nor of iron produced, the blowing machine requires a little more fuel to produce the steam required to move it, than it did when cold air was used. At Wasseralfingen where the consumption of charcoal has not varied materially by the change from the cold to the hot air blast, they require more power with the latter, a larger quantity of air being necessary in running the furnace. It is not said that the dimensions of the blast pipe nozzle have been changed. At Ancy-le-Franc in August, 1834, the pressure at the governor remaining constant, that at the tuyere was observed to fall to one-half, when the air was heated. The size of the nozzle was increased, but there was not an adequate power to supply the air required, and the yield of the furnace diminished.

---

* By reference to this Journal, p.74, vol. xvi. a more convenient method of using the thermometer will be found.—Translator.

† If so, it would seem that it must be deficient in heating power.—Translator.

Tuyeres, cooled by water, have been substituted for the ordinary ones in furnaces using the heated air blast; the cooling effect of the blast being taken away, the ordinary tuyere is rapidly burned out. Cast-iron water tuyeres have been found to last longer than those of wrought iron; they wear out in from three to six months.

In many establishments the blast pipe nozzle is permanently attached to the tuyere, an arrangement which answers well when it is not necessary to clean out the tuyeres. When this is necessary, the common arrangement is to be preferred, and this is generally the case in the French works even where charcoal is used.

When the nozzle is not closely fitted to the tuyere, the blast is slightly cooled before it gets into the furnace, and part of it does not pass in.

II. ON THE EFFECTS AND ADVANTAGES OF THE HOT AIR BLAST.

The effect appears to be to increase the heat within the furnace, so that a refractory ore is fused; any stoppage in the furnace is prevented, and the working is more readily resumed after the furnace has been cooled. Less fusible ores may be used, less flux is required for their reduction, the slags are more fusible, and become spongy if water is thrown upon them when incandescent. This property has been observed only in the Styrian furnaces and others where charcoal is used as a fuel, and the ore is a manganesian carbonate of iron. Further, grey pig iron is obtained with every kind of ore, this variety of iron requiring a high temperature for its production. Generally the heated air and combustible gases which issue from the trunnel head, are diminished in quantity and the heat is more concentrated in the lower parts of the furnace; a source of great advantage, but which causes a more rapid destruction of the hearth and boshes.

The working of the furnace when heated air is used is comparatively easy, there are fewer cases of clogging and they are readily remedied; the tuyeres are almost always free, no slag collecting and hardening about them. Frequently, a clogging in the furnace may be removed by raising the temperature of the blast. The advantages may be succinctly enumerated as follows.

1. A change in the iron which becomes more grey, and even black, and the slag is more fluid than when cold air is used.
2. An increase in the quantity of ore which a given weight of fuel will bear, whence results a diminution in the quantity of fuel required to produce a ton of metal, after the fuel required to heat the air has been taken into account.
3. A diminution in the quantity of flux, to which there are, however, exceptions.
4. An increase in the daily yield of a furnace.

We do not enumerate among the advantages that of using crude coal, because it has been ascertained both in Wales and at Decazeville, that this may be done with the cold air blast.

In regard to the quality of the iron produced by the hot air blast, the following facts have been collected.

It has been asserted that iron, thus obtained, requires to be remelted when it becomes duly tenacious, and yet the Lyonese founders complain that the iron of Vienne is weak. On the other hand, iron from the Torteron furnace was cast into shells which required more powder to burst them than similar ones made from iron procured by the cold blast, the strength having been nearly double, in the former case, of that in the latter.

In England there appears to have been no sensible difference between the castings made from iron obtained by the two different methods.

The same uncertainty prevails in regard to the forged iron obtained from pigs reduced by the aid of the hot air blast. M. Dufrenoy and M. Debilly, consider the notions prevalent on this subject in England, to be founded in prejudice. My observations in the South of France have shown that there is, if any, a very slight difference in the quality of the iron in favour of that made by the cold blast. At one of the furnaces it was suggested that silicious ores gave a worse iron by this process than by the cold air blast, the great heat facilitating the union of the silicium with the carbon and iron. A careful analysis is required to demonstrate this theory, in favour of the probability of which it may be stated that at Firmy, where a very silicious ore is used, the iron made by the hot air blast is worse than that by the other process, and when refined, produces a worse malleable iron. It is remarkable, moreover, that the best iron is obtained when the ore is in excess in charging the furnace, in which case the iron is reduced at the lowest temperature.

[TO BE CONTINUED IN OUR NEXT.]

Composition and specific gravity of different kinds of Glass.

Ordinary flint-glass, according to Mr. Faraday's analysis, consists, in 100 parts, of silica 51.93, oxide of lead 33.28, potash 13.77, with minute portions of other substances. A specimen of the same kind of glass, manufactured for telescopes by the late M. Guinand, yielded the same chemist, silica 44.3, oxide of lead 43.05, and potash 11.75. Mr. Faraday found the specific gravity of M. Guinand's glass to be about 3.616, that of ordinary flint-glass 3.290, that of plate-glass 2.5257, and that of crown glass 2.5448.

Glass has usually been considered, without much actual inquiry into the subject, to be strictly a chemical combination of its ingredients, and in all respects a very perfect artificial compound. This, however, is far from being the truth, as will appear from the following facts. That the alkali in common glass of all kinds is in a very imperfect state of combination, many circumstances concur to evince. For example, Mr. Griffiths has shown, that if a small quantity either of flint-glass, or of plate-glass, be very finely pulverized in an agate mortar, then placed upon a piece of turmeric paper and moistened with a drop of pure water, strong indications of free alkali will be obtained; and that if the pulverization be very perfect, the alkali can be detected in other kinds of glass, containing far smaller quantities of it. This proves, that in whatever state of combination the alkali may be, it is still subject to the action of moisture. That flint-glass is by no means a compound resulting from very strong chemical affinities, and that the oxide of lead which it contains is as imperfectly combined as the alkali, has been shown experimentally by Mr. Faraday, and also appears from the tarnish which is produced on its surface by exposure to sulphuretted vapours, owing to the combination of sulphur with the lead. Glass which has long been exposed to the weather, frequently exhibits a beautiful iridescent appearance, and is so far decayed, that it may be scratched with the nail. The glass of some bottles of wine which had lain in a wet cellar near the Bank of London upwards of 150 years, examined by Mr. Brande, was soft, and greatly corroded upon the surface, in consequence of the partial abstraction of its alkali. After reciting some of these facts, and others of a similar description, Mr. Faraday observes, "Glass may be considered rather as a solution of different substances one in another, than as a strong chemical compound; and it owes its power of resisting [chemical] agents generally, to its perfectly compact state, and the existence of an insoluble and unchangeable film of silica, or highly silicated matter, upon its surface." See Mr. Faraday's Bakerian Lecture on the manufacture of glass for optical purposes; Phil. Trans. 1830, pp. 46—50.—*Parke's Chem. Cat., by Brayley. (Arcana, &c.* 1835.)

Carriage Wheels.

On the 27th of May, at the Institution of Civil Engineers, Mr. Walker's paper, on the subject of the most advantageous form for wheels of different kinds of carriages, having been read, a member remarked that there were some practical objections to the use of horizontal axles, which were not alluded to in Mr. Walker's communication—one, the difficulty of making the wheel perfectly secure from coming off the axle, as a greater strain is unavoidably thrown on the linchpin. The wheels of ordinary country wagons are usually much dished, and the axles slightly inclined downwards, by which arrangement, the principal strain is thrown on the shoulder of the axletree, and a very ordinary description of linchpin will answer the purpose. As far as regards friction, and, consequently, an easy draught for the horse, the straight axle and cylindrical wheel have the preference; but, for safety, strength, and durability, he thought the inclined axle and dished wheel superior; besides which, there exists much practical difficulty in constructing carriages with horizontal axles and cylindrical wheels. It was remarked, that one reason for the conical wheel being so much adhered to in practice, was the greater liability of the tire on the cylindrical wheel to get loose; by the constant rolling of a heavy weight frequently on a small extent of surface, the tire becomes slightly elongated, and, on a cylindrical wheel, gets loose, and may occasion accidents; the conical wheel provides against this, by its greater elasticity, and the tendency it has to become more flat in the dishing, and, in a slight degree, to stretch out the periphery. It was stated that, at first, the cylindrical shape was adopted in Jones' patent iron wheels; but it was found that, with upright wheels, the width of track was required to be seven feet, and some of the streets do not admit of such a vehicle passing; also, in crowded thoroughfares, the nave is exposed, and liable to come in contact with other carriages.—It was stated, that a wheel of a new construction had lately been attempted, and was likely to become an improvement; the rim and nave are of cast-iron, and the spokes of wrought-iron; a wooden band is put round the cast-iron rim, which again is surrounded and fastened on by a wrought-iron tire, secured in the ordinary manner.—It was mentioned that, in Austria, cylindrical wheels are invariably used for wagons and heavy carriages, but for light vehicles the dished wheel is generally preferred.—A member stated, that in the neighbourhood of Edinburgh, the common stone carts belonging to the Cragleith, and other quarries, are generally made with broad cylindrical wheels.

On June 3, the conversation on the subject of the best form for wheels of carriages was resumed. An ingenious method was adopted by Messrs.

Jones, to exhibit the friction occasioned by conical wheels: a carriage was run upon the edges of loose boards, placed side by side; it was shown that, while the board under the middle part of the wheel remained stationary, that at the outside was pushed forward, and the board on the inside, backward; such, however, can only occur when the whole breadth of the wheel touches the ground, which is seldom the case, a wheel of nine inches having frequently a bearing of only three inches, in consequence of the middle tire being made of larger diameter.—*Arcana, &c.*, 1835.

Rutter's Heat Process.

Dr. Daubeny brought before the meeting the economical employment of coal-tar in connexion with water as fuel, according to the method lately suggested by Mr. Rutter.* A discussion then arose as to whether the water in this case acts chemically or mechanically, or both, in facilitating the combustion of the tar. Mr. Macintosh stated, that by repeated experiments he had found, that coal-tar gave no more heat when burned than an equal weight of *splint* coal, the kind preferred, where a long continued heat is required. Mr. Low also stated, that from long experience he could affirm, that the use of water along with coal-tar was productive of no benefit whatever, and that 3 gallons, or 33 lbs. of coal-tar, give an equal amount of heating effect, fully, to 40 lbs. of coke, made from the Newcastle coal of the Hutton seam. From the discussion on this subject, which was protracted for some time, it appears to be established, 1. That tar may be used as fuel, but that it does not give much more heat than the same weight of the best coal. 2. That when mixed with water, it flows more easily through tubes, but does not appear to evolve more heat than when used alone.—*Jameson's Journal.*

Progress of Physical Science.

On some elementary laws of Electricity, by W. SNOW HARRIS, Esq. F. R. S. &c.

Mr. Harris has opened some new views of Electricity by decidedly original experiments; he concludes that many of the phenomena treated in the course of his paper do not seem to have been contemplated in the more perfect theories of Electricity.

The new instruments invented by Mr. Harris to render research more easy and results certain and measurable are 1. A new electrometer by divergence. 2. An electrometer measuring directly the attractive force of an electrified body in terms of a known standard of weight, estimated in degrees upon a graduated arc. 3. A unit of measure for electrical charges, furnished by a small jar with an attached discharging electrometer. 4. A balance electrometer. By the aid of these instruments, or of a combination of them with other general means of experiment, and with the electro-thermometer previously invented, the following laws have been established.

1. When the amount of surface of an electrical conductor is varied, or the quantity of electricity distributed upon a given surface, the figure of the surface being the same, the force of attraction for other bodies varies inversely as the square of the relative superficies.

Thus a given quantity of electricity being divided between two conductors of equal surface, each one exerts an attractive force of only fourth that which is exerted when the same quantity is distributed upon a single conductor.

---

* Originally suggested by Capt. Morey, of New Hampshire.

This law Mr. Harris considers to be connected with the following facts. That the force of attraction exerted between the two bodies, one of which is electrified, is more or less diminished by the presence of a neutral, or other body, sharing the attraction. This leads him to distinguish three elements peculiar to the conditions of electrical accumulation. 1st. The comparative quantity actually accumulated. 2nd. The quantity not sensible to the electrometer. 3d. The quantity appreciable by the electrometer. The first he calls *quantity;* the second *controlled quantity* or *controlled action;* and the third *free quantity* or *free action.* Mr. Harris limits the term *electrical tension* to "the electric force of a given quantity accumulated in a given space." The term *intensity* is different from this being "applied to the indications of an electrometer and immediately referable to what [he] has called the free action," that is to the operation of either a part, or the whole of the total force in a given direction, up to the point of discharge." The "intensity" by the law above stated varies as the square of the density of the electrical stratum or as the square of the "tension." In connexion with this subject Mr. Harris examines Singer's theory that the diminished intensity observed in disposing a given quantity of electricity on an extended surface is referable to the attractive force of the atmosphere, to the influence of which the electric particles become more extensively exposed. This view he finds to be inconsistent with direct experiment as it is also with the law above stated.

2. The heating effects of the same quantity of electricity is the same, the number of jars, and length of circuit through which the discharge is made, being the same. A change in the tension of the electricity produces no change in heating effect. This fact had previously been shown by Faraday, in regard to the magnetic and chemical effects of electricity.

3. The distances of discharge between two electrified conductors varies directly as the quantity accumulated upon a given surface. The distance through which an electrical accumulation can discharge itself in air of a given density is an accurate measure of the comparative quantity in a unit of surface. The same law of relation holds when the surfaces are varied, thus the distance of discharge is invariably as the discharging surface, for a given quantity of electricity. This third law is consistent with the first.

4. It follows from the third law that the resistance of the atmosphere to the passage of electricity, is the same for all distances, being produced simply by its pressure.

When the density of the air is diminished, the distance of discharge (striking distance) varies inversely as the density, the quantity of electricity accumulated on a given surface being the same. The quantities of electricity required to overcome a given striking distance vary directly as the density of the air. These conclusions accord with the first law.

The temperature of air has no effect on its conducting power for electricity otherwise than as it changes the density. If therefore heat be material it is a non-conductor of electricity, not impairing the insulating power of air which contains it.

5. The resistance of conductors to the passage of electricity is of a different kind from that of air and other non-conductors; it is, other things being the same, directly as the length of the circuit.

Heat impairs the conducting powers of conductors for electricity, as has been asserted by Davy and Professor Christie, but denied by Professor Ritchie.

6. The attractive force of plane conductors of a given area charged with a given quantity of electricity varies with the figure, being greater as the perimeter is greater. This force is therefore least when the area forms a circle and greatest when it is extended into an indefinite right line. The perimeters being the same the attractive forces (intensities) are inversely as the areas.

The electrical capacities of a sphere or cylinder (that is the quantity which they can receive with a given intensity,) are the same as of the plane figures into which it may be supposed to be rectified.

[TO BE CONTINUED IN OUR NEXT.]

Mechanics' Register.

List of American Patents which issued in October, 1835.

		Oct.
589.	*Double Speeder.*—William Field, North Providence, Rhode Island,	6
590.	*Lampwicks, raising.*—Samuel Rust, New York,	6
591.	*Pelisse Wadding.*—Stukley Turner, Cranston, Providence County, R. I.	6
592.	*Planing Boards, &c.*—Reid R. Throcmorton, New York,	6
593.	*Fire Places.*—Ebenezer S. Greely, Dover, Penobscot, Maine,	6
594.	*Clover Seed, &c. cleaning.*—Moses Davenport, Philips, Somerset Co., Maine,	6
595.	*Silk-worms, rearing.*—Gamaliel Gay, Poughkeepsie, New York,	6
596.	*Saw Mill.*—Uri Emmons, New York.	6
597.	*Thrashing &c. Machine.*—Russel Bradley, Williston, Vermont,	6
598.	*Spring Saddle.*—Joel Woodward, Marshalton, Pennsylvania,	6
599.	*Stave and Shingle Machine.*—John Everhart, J. Pearson, J. Morford and N. Everhart, Wayne, Ohio,	6
600.	*Alcohol from Apples.*—Anson Wolcott, East Bloomfield, New York,	6
601.	*Ploughs.*—William Walker, Washingtonville, Pennsylvania,	6
602.	*Caoutchouc, cutting.*—William Atkinson, New York,	6
603.	*Ropes, laying.*—John Goulding, Boston, Massachusetts,	10
604.	*Hemp, &c. halcheling.*—John Goulding, Boston, Massachusetts,	10
605.	*Horse Power.*—Moses Davenport, Philips, Somerset County, Maine,	10
606.	*Tin Baker.*—Nathaniel D. Whitin, New York,	10
607.	*Cooking Stove.*—Elnathan Samson, St. Lawrence County, New York,	10
608.	*Clover Seed, &c. thrashing.*—Asa Burgess and Herman Baldwin, Litchfield County, Connecticut,	10
609.	*Hydrostatics and Pneumatics.*—R. Mills H. B. Fernald, City of Washington,	10
610.	*Washing Machine.*—John O. Geer, Norwich, Connecticut,	10
611.	*Staves, cutting.*—George Pack, Sullivan, New York,	10
612.	*Rail-roads.*—Roswell Bourne, Lancaster, Massachusetts,	10
613.	*Churn.*—Asahel Bacon, Windsor, New York,	10
614.	*Rotary Steam Engine.*—Arnold Buffum, Philadelphia, Pennsylvania,	10
615.	*Doffer for Wool Cards.*—Stephen R. Parkhurst, Providence, Rhode Island,	10
616.	*Grates or Grate Bars.*—Jordan L. Mott, New York,	14
617.	*Roads, constructing.*—Thomas Earl, Burlington, New Jersey,	14
618.	*Cast-iron Window sash.*—James S. Stoddard, Macedon, New York,	14
619.	*Canal Boats.*—James O'Connor, Philadelphia,	14
620.	*Springs of Carriages.*—Henry Pace, Senr. Cincinnati, Ohio,	14
621.	*Lathe.*—James Haven, Newport, New Hampshire,	14
622.	*Rail-road Car.*—George W. Cleaveland, Baltimore, Maryland,	14
623.	*Stove, or Furnace.*—Denison Olmsted, New Haven, Connecticut.	14
624.	*Gimblets and Augers.*—Orville B. Percival, East Haddam, Connecticut,	14
625.	*Washing Machine.*—Henry Ault, Philadelphia, Tennessee,	14
626.	*Fire Arms.*—Samuel Ladd, Waltham, Massachusetts,	14
627.	*Felloes, cutting.*—J. S. Brown and J. T. Barker, Philips, Maine,	14
628.	*Mill for Coffee, &c.*—David Richmond, M'Arthurstown, Ohio,	14
629.	*Felloes cutting.*—W. Braley and M. L. Worthley, Philips, Maine,	14
630.	*Bridges.*—Richard T. L. Witty, Lowell, Massachusetts,	14

631.	*Sparks, arresting.*—Hunt C. Wiatt, Weldon, North Carolina,	15
632.	*Cooking Stove.*—Horatio B. Wade, Cincinnati, Ohio,	17
633.	*Coal Stove, Anthracite.*—Eliphalet Nott, Schenectady, New York,	17
634.	*Tanning, preparing Skins for.*—J. C. F Saloman, Reading, Pennsylvania,	17
635.	*Steam Boilers.*—J. C. F. Saloman, Philadelphia, Pennsylvania,	17
636.	*Ploughs.*—Jarius S. Tefft, Amherst, New York,	17
637.	*Washing Machine.*—Isaac Spicer, Norwich, Connecticut,	17
638.	*Screw for Glass Knobs.*—Orrin Newton, Pittsburg, Pennsylvania,	17
639.	*Cement for Cisterns, &c.*—W. H. Carson and G. Roberts, York, New York,	17
640.	*Biscuit, &c. cutting.*—T. Havener and T. H. Havener, Washington City,	17
641.	*Calendering Cloth.*—Zenas Bliss, Johnston, Rhode Island,	17
642.	*Roofs, covering.*—Phinehas Burgess, Brooklyn, New York,	17
643.	*Crackers, &c. cutting.*—William R. Nivens, New York,	17
644.	*Feathers, cleaning.*—George Reynolds, East Hartford, Connecticut,	17
645.	*Planing boards, &c.*—Reid C. Throckmorton, New York,	22
646.	*Bricks and Tile.*—Benton P. Coston, Sterling, Pennsylvania,	22
647.	*Surveyor's Compass.*—Samuel R. Miller, Port Royal, Virginia,	22
648.	*Tubes and Hinges.*—William Shaw, Buffaloe, New York,	27
649.	*Mortising Timber.*—John M'Clintic, Chambersburg, Pennsylvania,	27
650.	*Cars, &c. propelling.*—Alexander M'Grew, Cincinnati, Ohio,	27
651.	*Sawing Stone.*—Daniel Bunnel, Xenia, Ohio,	27
652.	*Sugar, &c. boiling.*—John Steele, jr. New York,	27
653.	*Stove.*—Philip Benedict, Lancaster, Pennsylvania,	27
654.	*Oven.*—Jacob Baldwin, New York,	27
655.	*Boots, &c. cutting.*—Josiah T. Buck, New Canaan, Connecticut,	27
656.	*Horse Collars.*—Caleb Angerine, New York,	27
657.	*Moulds for Sugar, &c.*—Charles Duncan, Williamsburg, New York,	27
658.	*Power Motion Machine.*—David Russell, Tuscambia, Alabama,	27
659.	*Portable Saw Mill.*—David Russel, Tuscambia, Alabama,	27
660.	*Rail-road Carriage.*—William T. James, New York,	27
661.	*Fire-place.*—John Chapin Howard, Howard's Valley, Connecticut,	27
662.	*Cotton Whipper.*—Luccan Osgood, Pomfret, Connecticut,	27
663.	*Cotton Seed, hulling.*—A. Miller and T. Lawes, Washington County, Miss.	27
664.	*Plough Coulters, &c.*—Samuel A. Sperry, Washtenaw, Michigan Territory,	28
665.	*Lock for Drawers.*—Edward Brown, Lynchburg, Virginia,	28
666.	*Cloths, drying.*—Stephen R. Parkhurst, Worcester, Massachusetts,	28
667.	*Planing Machine.*—Ira McLaughlin and Hiram Hill, Sunderland, Vermont,	28
668.	*Staves, dressing.*—Joseph Sweet, Lycoming County, Pennsylvania,	28
669.	*Corn, crushing, &c.*—Anderson P. H. Jerdon, Madisonville, Tennessee,	28
670.	*Cement.*—Charles Clinton, Minnisink, New York,	28
671.	*Horse Power.*—A. Trahern, H. Heberling, Wm. E. Lukins and J. Heberling Harrison County, Ohio,	28
672.	*Ploughs.*—John W. Jardan, Lexington, Virginia,	28
673.	*Gridiron, rotary.*—Kellog Strong, Meriden, Connecticut,	28
674.	*Cutting Teeth, &c.*—Andrew T. Mirven, Lycoming County, Pennsylvania,	28
675.	*Pumps.*—Joseph Redelsperger, Mansfield, New Jersey,	28
676.	*Rotary Pump.*—C. Peters and Benjn. Dean, Poughkeepsie, New York,	28
677.	*Truss, spring.*—Henry Reid, Augusta, Georgia,	28
678.	*Comb, metallic.*—Nathaniel Bushnell, Middletown, Connecticut,	28
679.	*Taylor's Measure.*—Frederic A. Fairchild, Columbus, Georgia,	28
680.	*Steel Yard.*—C. F. Dahl, Pittsburg, Pennsylvania,	28
681.	*Stove, or Fire Place.*—Daniel Sutherland, Lisbon, Maine,	28

TO READERS.

Owing to the press of original matter for the present number of the Journal, it has been necessary to omit many selections prepared for the number. This has been done in those departments which are most copiously represented in the original matter.

The next number will contain a further portion of the report of the Committee on the explosions of Steam-boilers.

The *Mechanics' Register* will also be supplied with selections at present unavoidably excluded. COM PUB.

CELESTIAL PHENOMENA, FOR FEBRUARY, 1836.*

Calculated by S. C. Walker.

Day.	H'r.	Min.				
3	7	4	N. App. ☽ and 42 Leonis,	,6, ☽	N. 1′.6	V.
3	12	41	Im. i. Leonis,	,6,	47°	33°
3	14	4	Em.		247	280°
8	16	13	Im. ♄ Libræ,	,6,	70	53°
8	17	27	Em.		220	221°
28	6	27	Im. λ Cancri,	,6,	76	19°
28	7	52	Em.		268	219°

Meteorological Observations for October, 1835.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches			Inches.	
	1	39°	57°	29.65	29.50	W.	Brisk.		Lightly cloudy—flying clouds.
	2	58	63	.43	.43	SW.	do.		Lightly cloudy—flying clouds.
	3	43	54	.46	.50	W.	do.		Clear—flying clouds.
	4	43	62	.70	.66	SW.	Moderate.		Cloudy—flying clouds.
	5	53	69	.76	.76	S.	do.		Cloudy—rain with high winds.
☉	6	63	58	.45	.55	SW. W.	do.	1.20	Rain—cloudy.
	7	49	55	.70	.90	W.	do.		Flying cloud—cloudy.
	8	39	54	.95	30.05	W.	do.		Clear day.
	9	39	56	30.10	.05	W.	do.		Clear day.
	10	42	62	30.00	.00	W. SW.	do.		Clear—hazy
	11	44	66	29.90	29.90	SW.	do.		Hazy—do.
	12	49	59	30.14	.16	NE.	do.		Cloudy—clear.
☾	13	52	61	.15	30.05	SW.	do.		Cloudy—lightly cloudy.
	14	44	70	.00	.00	SW.	do.		Hazy—do.
	15	56	64	.00	.00	SE.	do.		Cloudy—hazy.
	16	56	70	.08	.10	SE.	do.		Cloudy—do.
	17	52	63	.00	.10	E. NE	do.		Cloudy—do.
	18	61	74	.05	.05	SE.	do.05		Cloudy—rain—flying clouds.
	19	63	75	29 98	29.98	S. SW.	do.		Cloudy—cloudy.
	20	60	76	30.06	30.06	SE.	do.		Cloudy—fog—lightly cloudy.
	21	63	75	.10	.06	SE.	do.		Fog—hazy.
⊗	22	60	70	.06	.12	SE.	do.		Cloudy—lightly cloudy.
	23	54	63	.10	.10	SE.	do.		Fog—cloudy.
	24	47	60	29.97	29.97	NW.	do.		Cloudy—flying clouds.
	25	38	52	30 25	30 25	N.	do.		Clear—frost—clear.
	26	33	57	.20	.15	SE.	do.		Clear—frost—clear,
	27	44	60	.20	.23	SE.	Calm.		Clear—clear.
	28	44	62	.20	.20	W.	do.		Partially cloudy—clear.
☽	29	45	65	.10	.10	S.	Moderate.		Fog—hazy.
	30	57	62	29.95	29.85	S.	do.	.13	Heavy fog—rain.
	31	45	57	.90	30.00	W.	do.		Cloudy—clear.
	Mean	49.57	62.93	29.95	29.93			1.38	

	Thermometer.	Barometer.
Maximum height during the month,	76. on 20th.	30.25 on 25th.
Minimum do. .	33. on 26th.	29.16 on 12th.
Mean do. .	56.22	29.94

---

* The Celestial Phenomena for 1836, include all the occultations of fixed stars by the Moon to the 6th magnitude inclusive visible at Philadelphia.

The angles under N. and V. respectively denote the angular distance of the point of immersion or emersion, from the *apparent* north or vertical point of the Moon's disc, as seen in a telescope which inverts. These angles are reckoned to the right or apparent west round the circle.
S. C. W.

JOURNAL

OF THE

FRANKLIN INSTITUTE

Of the State of Pennsylvania,

AND

MECHANICS REGISTER;

DEVOTED TO

Mechanical & Physical Science, the Arts & Manufactures,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

(*Continued from page* 20.)

IV. The next query may be thus stated: *when steam, surcharged with heat, is produced within a boiler by the contact with heated metal, does this steam remain surcharged, or does it take up water from contact with that in the boiler, and become saturated steam?* If the latter supposition be correct, at what pressure and temperature with regard to the temperature of the surcharged steam, and to that of the water on which it rests?

The answer to this question is given by the experiments just detailed; and as they established the negative in relation to the surcharged steam becoming saturated, there was no necessity for a repetition of the experiments to ascertain the precise temperature of the water in the boiler. When fire was applied to the top of the boiler, the water within was at 318° Fah.; a moderate fire was kept up below, and one so nearly uniform, that great variations from that temperature could not have taken place, and which the results satisfactorily show, did not occur. If we assume that during the experiments the temperature was 308½° Fah., a remarkable correspondence will be found in the observed pressures, and in those calculated on the supposition that this steam was expanded by heat, as a gas would have been, without any addition of water. The table below gives the temperatures of the surcharged steam observed at different times during the course of the experiments; the pressure shown by the gauge at that temperature; the pressure which would have been produced by heating steam at 308½° to the temperatures given in the first column by the mere effect of expansion; and the pressures of saturated steam at the different temperatures.

Temperatures of surcharged Steam.	Corresponding pressures from experiment.	Pressures calculated from expansion of Steam, 308½° by heat.	Pressures of saturated Steam at the different temperatures.
308½		5.2	
376	5.7	5.6	10.4*
462	5.8	6.2	31.6
506	6.1	6.5	48.0
526	6.6	6.7	57.3
533	6.8	6.75	61.1

A comparison of the second and third columns shows that in these experiments, which lasted more than two hours, the surcharged steam remained in contact with water without acquiring from it the water necessary to convert it into saturated steam, but retaining its surcharged state. There is nothing to warrant the belief that any of the surcharged steam was condensed by the water.

V.—*Inquiry in relation to Plates of Fusible Alloys.*

It is well known that one of the most scientific nations of Europe relies, particularly, as a means of safety for steam boilers, on the use of plates of fusible metal. The plates are alloys of tin and lead, or of these two metals with bismuth, the proportions of the component metals regulating the point at which they fuse. In France these alloys are prepared at the royal mint, where plates made from them, or ingots of the alloys may be purchased for use. The examinations which must have been made to determine the proportions of the metals necessary to produce an alloy fusing at a given temperature, and the circumstances of fusion, have not, as far as the committee know, been made public. A table of the fusing points of different alloys of tin, lead, and bismuth, &c., was drawn up by Parke, from experiment, and is contained in his chemical essays, vol. ii. page 615. This table was made the basis of the investigations† undertaken by the committee, but they soon found it convenient to depart, more or less, entirely from it.

The method employed by Parke for determining the fusing point of a metal, or rather the solidifying point of the melted metal, was ingenious. On melting a metal, and allowing it to slowly cool to the point of congelation, and observing a thermometer plunged in it, a rise of temperature, and then a stationary point, is observed; this is a point where a change is going on, by which the heat given out in the change is equal to that of which the metal is robbed by the surrounding medium. This point usually coincides with the passage of the metal to the solid state, from what may be either the liquid state, or a semifluid state, similar in aggregation to sand; sometimes the alloy is solid throughout, before the stationary point arrives; and sometimes there is more than one such point.

The stationary point is not that at which the alloy, when used as a fusible plate for a boiler, gives way; the plate being covered by a perforated brass disk, to prevent its being pressed outwards before fusion, and so reduced in thickness as to burst, the metal is not forced out through these openings until perfectly fluid; if any part of the metal becomes fluid before the rest, and gives way, the rest being in the sandy state, just spoken of, the particles seem to act like those of sand in a similar case, and to oppose an effective resistance to the pressure of the steam; these facts will be further developed in the examination of the application of these plates.

---

* These numbers are obtained from the table of Arago and Dulong, by interpolating between the terms; and though not rigidly correct, are abundantly so for this purpose; the last two numbers are obtained, by substitution, in the formula given by these experimenters, as resulting from their observations.

† At the time these experiments were made, the paper of Rudberg Ann. de Chimie. et de Phys. Vol. 48, had not appeared.

The stationary points, when taken with due reference to the state of the metal at the time, afford so many approximate marks by which to compare together the fusibilities of the plates, and to ascertain whether they bear a due relation to each other, when fused, in place upon the boiler; and to study the alloys themselves. In composing alloys of the metals, before referred to, the tin was fused first at as low a temperature as possible, then the bismuth and lead added, the heat being kept up; these metals were readily taken up by the liquid tin, and were thus little exposed to oxidation: the surface of the alloy was always protected by a stratum of oil. The metal was constantly stirred to promote the uniform diffusion of the different metals throughout each other.

The alloy being liquid, a thermometer, of which the errors had been carefully ascertained, was plunged into it, and the fall noted until it reached the lowest point; the rise to the stationary point followed, and at this the thermometer usually remained for such a length of time, often some minutes, as to render any error of observation unnecessary. Some of the alloys have no stationary point, properly so called, and the beats of a second's pendulum were used to determine the rate of their loss of heat. When the quantities of metal used were inconsiderable, the heat was observed to be carried off so rapidly as to lower, or entirely to destroy, the stationary point: to avoid this, the crucible containing the alloy, was placed in a second one, the edges of the former resting on the middle of the sides of the latter. The quantity of metal used was never less than between five and six ounces, troy.

The stationary point being at the passage of the liquid metal to the solid state, or at some interior change of the solid itself, the thermometer was entangled in the metal; and in moving the alloy, to remelt it, the instrument was endangered.* This was remedied by the use of a small cylinder of very thin sheet iron, containing mercury. This cylinder was placed in the alloy, and filled up to the surface of the metal with mercury, and the thermometer could now be readily placed and removed. Care was taken to ascertain that the stationary point, given in the cylinder, was the same with that shown by the naked thermometer. As some of the alloys expanded considerably on congealing, it was supposed that the cylinder might prevent error from the compression of the bulb of the thermometer, but no such compression in the instrument used was detected by frequent trials.

As the alloys were intended for ordinary use, it was deemed advisable to ascertain how far the impurities of the metals, as they occur in commerce, would cause a variation in the fusing point. Tin has a very uniform purity in commerce, the grain or stream tin being always accessible. The bismuth of commerce being obtained principally from the native bismuth, is probably not very variable.† The lead contains variable quantities of silver, copper, and iron. The first experiments were made on the fusing point, on various specimens of common tin: this tin showed, by reagents, a trace of iron and of copper, as impurities. The fusing point of grain tin is 442° F.

---

* Although the instrument was frequently used in determining the stationary points, no permanent changes in the indications of the instrument, such as was noticed by M. Rudberg, took place.

† It is proper to state, however, that some specimens were procured, obviously obtained from the sulphuret, and contaminated with it. They were not used.

COMMON TIN.	*Stationary Point.*	*Remarks.*	
Specimen, No. 1.			
First experiment,	441.75°	Thermometer in cylinder.	
Second, do.	442.25	do.	do.
Third, do.	441.75	Without cylinder.	Stirred.
Fourth, do.	442.00	do.	do.
Mean,	441.94		
Specimen, No. 2.			
First experiment,	441.50	In cylinder.	
Second, do.	442.00	do.	
Mean,	441.75		
Specimen, No. 3.			
First experiment,	438	In cylinder.	
Second, do.	439	do.	
Mean,	438.5.		
Specimen, No. 4.			
First experiment,	441	Thermometer in cylinder.	
Second, do.	443	do.	do.
Third, do.	441½	Without cylinder.	Stirred.
Fourth, do.	443	do.	do.
Mean,	442.12		
Specimen, No. 5.			
Single experiment,	442	In cylinder.	

The fusing points of the different specimens varied slightly, but the differences, in a practical point of view, are nothing.

The fusing points, in the case of tin, coincide nearly with the stationary points, the metal passing rapidly from the liquid to the solid state. When the change of state is rendered more rapid by agitation, the stationary point is slightly raised; the heat, which is produced in the change, not having time to be carried off, as when the change is allowed to proceed by degrees.

Lead from the Paris mint, of the kind used for cupellations, and containing a very minute quantity of silver, as an impurity, was next compared with the common lead used by plumbers. The experiments were as follows:

Pure Lead.	*Stationary Point.*	*Common Lead.*	*Stationary Point.*
First experiment,	601°	First experiment,	604°
Second, do.	601	Second, do.	604
Third, do.	602		
Fourth, do.	602		
Mean,	601.5	Mean,	604

An attempt was next made to ascertain what effect the impurities shown by the fusing point of lead would have upon the fusing points of alloys, into which it entered. Alloys, in atomic proportions were selected, as much was expected from them in the way of avoiding the slow passage from the liquid to the solid state, which was observed to be the property of certain mixtures of the metals. Alloys of tin and lead were therefore made in atomic proportions; first, of grain tin and the lead already spoken of, from the Paris mint; the second, of block tin and common lead. The tin was employed in multiple proportions, as being the more fusible metal, it would probably enter more largely than the other, into the composition of fusible plates for steam-boilers. The equivalent of lead is 104; of tin, 58; the first alloy was composed of the two metals, united in this proportion, the total weight of the components being about ten ounces, troy; a new equivalent of tin was next added, and so on, through the series: the results are given in the following table.

Equivalents of		Stationary point.	Number of Observations of which the stationary point is the mean.	REMARKS.
Pure Lead.	Grain Tin.			
1	1	354¾	2	Begins to lose fluidity at 430°, soft solid at 410°, do. 400°, still yields to a stick at 350½°, rises to 354¾, the stationary point, hard and unyielding.
1	2	357¾	2	Thermometer fell to 356½°, metal still liquid, congeals very irregularly, rises to stationary point, parts of the metal still fluid.
1	3	357½	1	
1	4	358¾	2	Thermometer fell to 365°, rose rapidly to 369°, where it was stationary for a short time, then fell to 357½, where it was stationary for some minutes.
1	5	357¾	5	Thermometer was 30 secs. in falling from 369½° to 362½, very slow: stationary at 357¾ for 100 secs. No other stationary point to 200°.
1	6	358¼	4	Thermometer stationary at 377°, in one experiment, then fell to 358°, stationary 35 secs.: at 377 soft solid, easily penetrated, hard at lower stationary point. In another expt. fell to 377°, then rose to 379°, whence it fell rapidly to 358¾°, the lower stationary point.

Equivalents of		Stationary point.	Number of Observations of which the stationary point is the mean.	REMARKS.
Common Lead.	Block Tin.			
1	1	354½	1	At 408½°, a stick only pierces the surface, solid below. Thermometer fell to 352°.
1	2	357½	5	Parts of the alloy liquid at stationary point.
1	3	357¾	1	
1	4	359¾	2	In one experiment therm. rose from 366½° to 367°, alloy granular, semi-solid; fell to stationary point, alloy solid. By stirring the upper point was obliterated.
1	5	360½	2	In one experiment the therm. rose half a degree from 376½°, then fell rapidly to stationary point.
1	6	359¾	2	Therm. rose half a degree above 383½°, in one experiment, and was stationary a short time at 381¼°, in another experiment; at both these times the metal was beginning to lose fluidity. Solid at lower stationary point.
1	7	359¾	1	Thermometer fell very slowly from 387° to 386¼, and alloy began to congeal at surface.

Upon this table we remark, first, that at all the stationary points, except in the alloy of 1 lead to 2 tin, the metal was solid at the stationary point; second, that although the proportion of tin varied from one to six, and even to seven, the stationary point was not changed more than 3½° for the first series, and 5¼° for the second; third, that in the proportion of one of lead to four of tin, a second stationary point appeared at the point at which the metal began to lose its entire fluidity, and was found in the higher parts of the series, rising with the increased proportion of the more fusible metal, with difficulty detected at times, and disappearing by agitation of the alloy; fourth, that the tin and lead of commerce give, for the lower stationary points in the same alloys, quantities nearly the same. A comparison of the upper stationary points appears below.

Equivalents of		Upper Stationary Point for	Upper Stationary Point for
Lead.	Tin.	Pure Metals.	Common Metals.
1	4	369°	367°
1	5	369	376½
1	6	378	382⅜

The variable nature of the results, seems to point out rather the difficulty of detecting the upper point and the effect of accidental circumstances, than that it is affected materially by the impurity of the metals as found in commerce. This upper point rises with the proportion of the less fusible metal. The number of degrees between it and the corresponding point, for the solid state of the metal shows one difficulty to be obviated in the use of the fusible alloys. For example, the first in the table, just given, has 10¾° between the point at which it begins to lose fluidity, and that at which it is solid; the second has 11¼°, and the third 29¾°; these defects, it was hoped, would not have been found in alloys in definite proportions. They indicate that the variety of combinations in definite proportions is not considerable, if even it exceeds a single one; and that when the metals are mixed in definite proportions, the alloys are in fact combinations, or mixtures, of one or more chemical compounds with the metals themselves. If this be the case with alloys in which the proportions are in the ratio of the equivalents or in multiple ratios, it would seem to follow certainly, that in alloys made in proportions not definite, the same fact would appear. That this is so, and that its effects are of importance in practice, will appear subsequently.

The second part of the inquiry relates to the action of fusible plates when in place on the boiler; it supposes proper alloys, fusing at required temperatures, to be composed, and then studies the causes, modifying the action of them when placed on the boiler. In the first apparatus for the use of these plates, the attempt was made to introduce them within the boiler, but the difficulty of replacing a plate which had fused by another plate, led to the abandonment of this apparatus. The opening made in the boiler, when the plate was withdrawn, was so great that the contents of the boiler were violently discharged through it, before the operation of replacing the plate could be effected. This observation has a bearing upon the plans for making large openings in boilers of full size, to avoid explosions.

The apparatus finally used was a sliding plate, moving in a groove upon the upper side of the boiler, as shown in Plates 1 and 3, where *s* represents the slide moved by the lever *r;* in the middle of the slide was an aperture slightly conical, for receiving the fusible plate, this aperture was eight-tenths of an inch in diameter. By means of the lever, the plate could be brought over an opening in the top of the boiler, or the solid part of the slide might be made to cover the same opening. The fusible plate was covered by a disk of brass, the edge of which projected over the plate, and rested upon the slide. There were six holes drilled through this plate, each being about nineteen-hundredths of an inch in diameter. To retain the slide in its place, when pressed from below, and to retain the fusible plate when in a similar situation, the forked stem, L, pressed in the former position by one leg, upon the slide, *s*, in the other by the other leg upon the disk covering the fusible plate; the upper end of the stem entered a cavity in an adjusting screw, *t*, passing through the gallows, *u;* by this means allowance could be conveniently made for expansion. The lever for moving the slide rested, when the aperture in this latter for receiving the fusible plate coincided with the opening in the boiler, against an upright, projecting from the top of the boiler, and serving as a stop. By the use of this apparatus, the plates were applied very readily, were removed when fused, and the opening into the boiler closed with so much despatch as to prevent the foaming within from taking effect. The disk which covered the fusible plates, prevented in part the loss of heat from the upper surface.

The plates which were first cast, were intended for low pressures as most convenient for experiment, they were fifteen-hundredths of an inch in thickness. The observations made upon the manner in which they acted when in place upon the boiler, led to the question of the effect of varying the thickness upon their use. When a plate of sufficient thickness to prevent its giving way to pressure, verges towards its point of fusion; the top part, which is in contact with the metal disk, melts, and flows over the holes in the disk; sometimes it accumulates until the liquid rolls off the plate. The temperature rising, a small pellet of the more perfectly fused parts is thrown out by the steam, the flow of which is instantly checked; this is repeated frequently, until a breach through the plate is made, and the uninterrupted flow of steam takes place. If the plate be removed at once, a very small hole appears, which would gradually have been widened by the action of the escaping steam, probably before the entire fusion of the plate. The under surface of the plate appears oxidized and the fusion to have taken place at the top: the plate has contracted in its dimensions, and the periphery of the upper surface has lost its circular figure, which is tolerably well preserved by the lower surface. To give some idea of the extent to which a plate such as just supposed, may lose its substance before giving way, two measurements are subjoined. Before fusion, the diameter of the upper surface of the plates was eighty-four hundredths of an inch; the lower diameter eighty-two hundredths of an inch; the thickness of the plates, fifteen hundredths. After the plate had given way, the diameter of the hexagonal figure into which both the surfaces had passed, was about seventy-nine hundredths for the first, seventy-four hundredths for the second; the diameter of the lower surface, which was still nearly circular, was, for the first, seventy-six hundredths; for the second, sixty-nine hundredths; the thickness of the first was about twelve-hundredths, of the second, one-tenth of an inch; the thickness not being uniform in all parts. The first plate had lost, therefore, nearly three-tenths, and the second half of its substance, without allowing the passage of steam.

The observed oxidation of the lower side of the plate, led to the supposition that it might retard the fusion of the plate, but no confirmation of this view was given by comparative experiments, with plates of which the lower surface was brightened, and of others in which the same surface was highly oxidated, the thickness in each case being the same.

In the course of the experiments on the effect of oxidation, the plates were much reduced in thickness by filing away the under surface, and the fusion of the thinner plates took place at points so much lower than those at which the thicker plates of the same alloy gave way, so as to require an examination of the cause.

Before proceeding with further detail, it may be well to state the general method of experimenting upon the plates. The stationary point of an alloy having been determined, and remarks made as to its point of fusion, plates were cast from it; and one of these being placed in the opening in the slide of the apparatus already described, was covered with the pierced disk, and the slide moved so as to bring the plate over the opening in the boiler. The steam was now raised, the temperature being noted from time to time, until the plate gave way; steam was then let off to keep the temperature from rising; the plate, which had just fused, removed, and one of an alloy, fusing at a higher temperature, substituted. The steam was again retained, and allowed to rise in temperature, the new plate pushed to its place, and the operation renewed. This course was continued until the alloy, fusing at the highest point of those prepared, had been used, or until the limit of the elasticity of steam, which could be produced in the actual condition of the boiler and state of the fire, was attained; steam was then let off, water thrown into the boiler, and a new series commenced. The tables which will be given, required many days of trial, and of close attention.

To try the effect of thickness on the fusion of the plates, three different thicknesses were cast of each of the alloys used; the first, or thickest, was fifteen-hundredths of an inch thick; the second, eight-hundredths; and the third, four-hundredths. There were five different alloys of tin, lead, and bismuth, composed; the stationary points of which, and the points at which they gave way in the boiler, appear below.

Number of experiment.	Number of alloy.	Temp. at which alloy begins to lose fluidity.	Stationary point determined by committee.	Thickness of plate.	Point at which the plates gave way in boiler.			Mean.	Pressures corresponding to the mean temperature of giving way.	
				Inch's.	Degrees Fah.					
1	1	275	250*		248	249†	249	248.3	1.9	* No true stationary point. Soft solid 250° to 254°.
2	"			.08	243		251	245.5		
3	"			.15	250			250	1.95	† Plate blown to pieces.
4	2	281¾	268‡		263	258		260.5	2.3	‡ Had another stationary point at 207°.
5	"			.08	254½			254.5		
6	"			.15	295	295§	292	294	4.2	§ Piece of plate blown out.
7	3		284		287	288	285½	286.8	3.7	
8	"			.08	290	298		294		
9	"			.15	296	303	304	301	4.6	
10	4	314	309½	.08	299			299	4.5	
11	"			.15	303			303	4.7	
12	5	328	320		298	299	298	298.7		
13	"			.15	314			314	5.7	

The plates of experiments 1, 2, and 3, were exposed to pressures tending to render them of less than one atmosphere; 1 and 3, the two extremes of thickness, show a great uniformity in the point at which they give way, and render it probable that some flaw, in casting the plate number two, caused its fusion at a lower point than that of either of the others; we see too, that at these low pressures the fusing point in the boiler coincided, very nearly, with the point at which the alloy was a soft solid in the crucible. In this case the thinnest plates, when properly cast, were probably thick enough to withstand the small pressure to which they were exposed, and therefore did not give way at lower temperatures than the thickest, each attaining the temperature at which they were soft solids.

The next series, Nos. 4, 5, and 6, with a less fusible alloy, show, first, that the thinnest plate was too feeble to resist the pressure of steam, and gave way before the metal lost its solidity; second, that the plate, eight-hundredths of an inch, was probably defective, as it gave way at a lower temperature than the thinner plates of No. 4. No. 6 presents a curious fact; the point of yielding of the plate, given by four experiments, is actually above the point at which the alloy from which it was composed became liquid: this would appear inexplicable to one who had not attentively observed the mode of fusion of these thick plates, and would lead to the suspicion of error. The observation of the point at which the alloy became liquid, was however, deduced from three trials; and four experiments, with the plates in place, are given, the extremes differing but three degrees. The explanation is to be found in the mode of fusion already spoken of; the more liquid parts of the alloy are forced out, the less fusible remain, and if strong enough to resist the pressure, the process goes on; this takes place, unequally, in different alloys. The importance of attending to such indications is obvious.

In the next series, the first thickness seems to have been decidedly too weak, and the second to have been hardly sufficient, while the third exhibits a point of fusion when the metal was in a softened state.

In the remaining experiments, both thicknesses were too inconsiderable to sustain the pressure, as appears by comparing the points at which the plates gave way, with the stationary points. Something of this kind seems to have been deduced from practice in the use of these plates in France, for the last royal ordinance, in relation to the means of safety to steam-boilers, prescribes for the plates a thickness of not less than nine-sixteenths of an inch, making of them fusible plugs rather than fusible plates.

Experiments were subsequently made on plates of greater thickness, the use of which led to an interesting termination to this series of experiments. Before, however, stating the results thus obtained, some further experiments with the plates just considered, will be described. These inquiries were directed to the effect which would be produced by the mode of casting the plates, upon their fusibility; it being not improbable that rapid cooling might so modify the physical properties of the alloy, as to change the fusing point from that of the same alloy when slowly congealed.

As low pressures afforded the most easy means of determining this point, plates were cast from the alloys of series No. 1, No. 2, and No. 3, and tried, in place, upon the boiler. Some of the plates were cast from metal at a high temperature, and the mould as cold as the perfect casting permitted; others, of the same alloy, in a heated mould allowed to cool slowly; and others from metal heated to a temperature as little above the point of fusion as possible. In the case of the higher temperatures, care was taken not to raise the heat so far as to oxidate rapidly either of the constituents of the alloys, thus changing the fusing point. A comparison of the results obtained, showed no greater differences than those which have been seen to occur between plates similarly cast, and from the same alloy; and the conclusion derived was, that the mode of casting has no effect on the fusing point, which is appreciable in this mode of applying them. The French instructions expressly recommend to those who make or use boilers, to obtain plates in preference to the fusible metal in ingots; on the ground that it will be found difficult to procure plates of the same fusibility with the ingot, from that form of the alloy. This remark led to the experiments just referred to, and the explanation of it which they give, refers to the undue heating of the alloy in the casting of the plates, since they show that the particular mode of casting produces no difference worthy to be regarded in a practical point of view.

Plates were now cast quite thick, viz.—one-fourth of an inch, of the alloy of eight parts of bismuth, eight of tin, and seven of lead; this alloy being intended to give way at a temperature corresponding to about one atmosphere of bursting pressure. The alloy was completely liquid at 275° Fah. and solid at 254° F.,* when examined in the crucible. The heat was raised as slowly as possible, so as to permit the full effect of the temperature indicated by the thermometer; the observations recorded are as follows:—

Thermometer in Steam.		Therm. on top of boiler.	Pressure.	REMARKS.
Therm.	Scale.			
Fah.°	Fah.°	Fah.°	Atmos.	
256	58		2.2	Plate $\frac{1}{4}$th of an inch. Metal stands fused in the holes of the brass disk covering the fusible plate.
260		254		Steam issues in a very small stream through chinks between the fused metal and an unmelted part within.
270	58	262	2.7	Steam issues as before; no clear passage through the plate. Steam kept for a long time at this temperature. Six minutes elapsed in raising temperature 4½ degrees.
292		279	4.0	Plate gave way, affording a free passage to steam.
258				A second plate of the same composition and thickness, put in place; fluid metal stands in the holes of the cap.
267	83		2.6	Metal which has oozed out remains in a fluid state upon the sliding plate of the apparatus.
299	93		4.5	Plate gives way, torn in a thin part.

The thermometer on top of the boiler dipped into the mercury in a small cistern, made by inclosing a space on the top of the boiler, with clay; so that the top of the boiler formed the bottom of the cistern. The first plate having failed to give way until the temperature within the boiler was twenty-four degrees above that at which the alloy, of which it had originally been composed, had been fluid, was examined with great care. The plate had decidedly given way to pressure, and not by fusion; it had lost its metallic lustre at the side where it was torn; yielded readily to the nail, which scraped off small particles. A piece of the plate being cut off and laid upon the top of the boiler, remained solid, though the portion which had oozed out, was perfectly fluid, near the same spot. The same remarks apply, generally, to the second plate. They afford a solution of the perplexing circumstances, which had occurred throughout these experiments, and which had led to so many trials to discover their cause.

The portions of the metal which oozed out from these two plates had their fusing points taken, by gradually raising their temperature in a bath of oil, while the alloy rested on a small shelf of copper, wholly immersed in the oil. The first portions of fluid metal which had oozed from both the first and second plates, melted at betwen 221 and 223 degrees, Fah., being solid at the lower, and perfectly fluid at the higher, of these two temperatures. The second portion which oozed out from the first plate, fused at between 230° and 233°, Fah., and a portion of that from the second plate was fluid at about 235½° Fah. The parts which were left, of the first plate, were a soft solid, at 299¼, fluid at one edge, at 312°, and entirely fluid at 345°.

---

* This alloy had no stationary point in passing from the liquid to the solid state; but some internal change in the solid at about 206°, produced a rise and stationary point at 208°.

The portions left, of the second plate, lost their cohesion, and could be broken by pounding, into small particles or grains, at 300¼°; and the whole was fluid at 356° Fah. A comparison of these results appears in the annexed table.

	First ooze.	Second ooze.	Residuum.	Entire plate before experiment.
	Fluid.	Fluid.	Fluid.	Fluid.
First plate, - -	223°	233°	312 *a* 345	254 *a* 275
Second plate, - -	223	235½ *a* 241½	356	

To pursue this subject further, by the clue thus obtained, only freeing the different oozes from accidental admixture, a small iron cylinder was made, closed at one end, and perforated near the closed end with a number of minute holes, not larger than the stem of a common pin. Into the cylinder was fitted, nearly tight, an iron piston, with a rod, to apply pressure. An alloy having been made and introduced into the cylinder, the whole could be heated in an oil bath to any desired temperature; and pressure being applied to the piston, the liquid parts would ooze out, through the small apertures near the end of the tube. The first alloy experimented upon was the same in composition with that just referred to; being composed of eight of bismuth, eight of lead, and seven of tin, by weight. This alloy was fluid at 254¼° Fah. At a temperature of 229°, some drops of fluid metal were forced out by pressure, and at about 239½° other portions were forced out. Both melted at 227° Fah. The portion left was a soft solid at 276¾° Fah.; fluid at 290½°. The alloy of one atom of lead, one of tin, and one of bismuth, is fluid at 273½° Fah., and that of one atom of lead, one of tin, and two of bismuth, at 219° Fah.

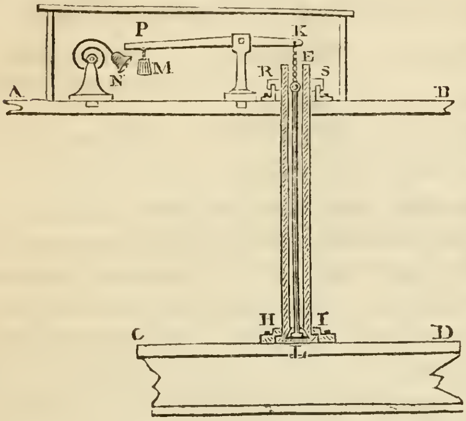
These experiments, the committee deem conclusive in regard to the use of fusible plates in the ordinary way, and they conceive that substituting fusible plugs of greater thickness, say half an inch, as has been directed by a recent ordinance in France, would not serve as a remedy to the defect thus exposed. The true remedy is to be sought in inclosing the fusible metal in a case, in which it shall not be exposed to the pressure of the steam, but only to its heating effect: the more fluid parts of the metal will then not be exposed to be forced out of the mass; and the whole will become fluid as if exposed to heat in a crucible. With this view of the subject, trial was made of an apparatus described by Professor A. D. Bache, in the Journal of the Franklin Institute, for October, 1832, under the title of an "alarm to be applied to the interior flues of steam-boilers."* This apparatus is obviously as applicable to a common boiler as to one with interior flues; the following description of it is given in the journal.

"A tube of iron, or copper," according to the material of the boiler, "closed "at the lower end, passes through the top of the boiler, its closed end reaching "the flue to which it is attached." "This tube, it will be observed, affords a "ready access to the flue, to ascertain its temperature, without any restraint "from packing." "A mass of fusible metal placed at the bottom of the tube," "will become fluid very nearly as soon as the flue takes the temperature of "fusion of the alloy." "To show when the metal at the bottom of the tube "becomes fluid, a stem is attached with a cord and weight," "or with a lever "and weight." "The weight and longer arm of the lever, descending, may be

---

* This paper was published in 1832, and the experiments of the Committee were made in 1833-4.

“ made to ring a bell, or, by appropriate attachments, to turn a cock, permit-
“ ting just enough steam to issue to give the alarm, and then to be closed at
“ once. A projection on the lower end of the rod prevents it from being
“ drawn from the metal until this latter is fused, and by widening the lower
“ part of the tube, making it slightly tapering, the metal is kept from being
“ drawn out by the rod.”



In the annexed figure “ AB is a section through the top of the boiler; CD, a corresponding section of its flue, EH represents a tube closed at the lower end, which is attached to the upper side of the flue. The mode of attachment by a projection on the tube and a ring screwed to the flue, is shown in the figure, as also the stuffing box, RS, through which the upper end of the tube passes. The lower part HI, of the tube, is made tapering, to retain the fusible metal. KL is the stem, the lower part being inclosed by the fusible metal, the upper part attached by a chain to a lever KP. The weight M, draws the rod KL upwards, and on the fusion the alloy HI, carries the lever below the bell N, which, being attached to a spring, rings an alarm.”

The form of this apparatus, which was subjected to trial by the committee, was essentially the same with that described. One of the tubes in which the thermometers were ordinarily placed, was used to contain the fusible metal, and as giving the more severe test, the short one entering only into the steam, was selected. For the convenience of removing the metal, it was placed in a metallic case, fitting loosely into the iron tube, and having a wire attached, by which it could be drawn out of the tube. This certainly diminished the sensibility of the apparatus, particularly, as the case was quite as thick as the inclosing tube, and as there was a small space between its convex surface and that of the tube; it was required, however, for the convenience of the experiments.

The results of the several trials are contained in the following table. The temperature was registered by the adjoining thermometer dipping into the water of the boiler, and already often referred to; it was raised as rapidly as possible in all the experiments except the first. The first four trials were made on an occasion specially devoted to this purpose, the last two were made incidentally when upon another subject.

Number of Trial.	Temperature.	REMARKS.
	Fah°.	
1	268	Stem rises. No particular attention paid to raising the temperature rapidly.
2	270	Stem rises. Steam raised rapidly.
3		Metal drawn out and suffered to cool, re-deposited cold in tube. Steam at 258°, and raised to 274° in 2½ minutes.
	274	Stem rises.
4		Metal drawn out and cooled. Steam at 250°, when metal was replaced. Steam raised to 274° in 3 minutes.
	274	Stem rises.
	252	Metal had not become solid again. Steam let off rapidly.
5	270	Melted below this temperature.
6	256	Stem rises. Metal remains a soft solid, so that the stem can be drawn out, until 240°.

A fact noticed during the experiments on fusible alloys was again verified in these experiments; namely, that the mixtures of metals require a considerable time to change their state of solidity or of fluidity, so that in the former case they may be heated above the true temperature of fluidity, and in the latter case they may be cooled much below this temperature, without solidifying. The alloy used in these experiments, appears to have put the apparatus very fully upon its trial in this respect, and the experiments were performed so rapidly as to give a further severe test. On the occasion devoted to the trials when the steam was not urged up with its greatest rapidity, the stem was drawn out at 268°, when more rapidly at 270°, and with the fire at its maximum intensity, when the water was raised in temperature 24° in three minutes, the stem was drawn out at 274°. In other experiments it gave way at 256°. The range is 18° Fah., corresponding at ten atmospheres, to less than two atmospheres, under the test of very severe comparisons. There appears no reason to doubt, that when tested by no more rigid modes than practice would furnish, this apparatus would not only apply as an alarm to prevent undue heating of the parts of the boiler, but as a manageable, and useful check, in ordinary cases, upon the safety valve.

Conclusions.

The conclusions deduced from the foregoing experiments, on metallic alloys, may be thus stated.

1st. The impurities of common lead, tin, and bismuth, are usually not such as to affect materially the fusing points of their alloys.

2d. When mixed in equivalent proportions, tin and lead formed alloys, not presenting the characters of distinct chemical compounds, in definite proportions. The alloys between the range of one equivalent of tin, to one of lead, and one equivalent of tin to six of lead, varied considerably in the interval between the temperature of commencing to lose fluidity, and that at which a thermometer, immersed in the solidifying metal, became stationary. These different alloys produced nearly the same stationary temperature in a thermometer plunged into the solidifying metal.

3d. Fusible metal plates covered by a perforated metallic disk, and placed upon a steam-boiler, show signs of fluidity at the disk, before the steam has attained the temperature of fusion of the alloy of which the plate is composed. This fluid metal oozes through the perforations in the disk, and the plate thus loses much of its substance before finally giving vent to the steam.

4th. The under parts of the plate are not kept from fusion by a protecting film of oxide there formed.

5th. The thickness of the plate is not important, provided only that it is sufficiently strong to resist the pressure of the steam at temperatures below its point of fusion.

6th. The temperature at which the plates are cast, and the rate of cooling of the cast metal, do not affect the temperature at which the plates give vent to steam.

7th. The effect stated in conclusion third, is explained by the nature of the alloys used, which are formed of portions of different fluidities; the more fluid parts, are forced out by the pressure of the steam, leaving the less fusible. These latter in general are burst, not melted.

8th. By pressure in a receptacle provided with small openings, this effect of separating the differently fluid portions of an alloy, may be imitated.

9th. Fusible alloys, used to indicate the temperature of any part of a steam boiler, should not be exposed to the pressure of the steam; at least not in such a way that the separation of the differently fusible constituents of the alloys may be effected.

Fusing Points of Alloys applicable to Steam Boilers.

The committee next proceed to give the results of their trials to determine metallic alloys proper to be applied to steam-boilers. This problem admits, of course, of a great variety of solutions. The metals used were limited to tin, lead, and bismuth; but still different mixtures of these may be made which will give alloys of the same fusing point. The property which was most desirable in these alloys was a small range of temperature in changing from the liquid to the solid state. This property, it will be seen, is difficult to attain, and the less fusible alloys of the first table, as well as the more fusible ones of the third, do not possess it. For the higher temperatures, alloys of lead and tin are applicable, and the question is reduced to an examination of the fusing points of different mixtures. The greater proportions of lead might be inferred to give the higher fusing points, and the less proportions the lower ones. Beginning with the alloy of equal weights of tin and lead, the following table gives fusing points between 355° and 503° Fah. The stationary points were taken as already described; all the alloys in the table, except the first, were hard before the stationary point occurred, and therefore this point indicated, in these cases, some internal change in the solid, and did not correspond to the passage from the liquid to the solid state. This seems not to have occurred to Mr. Parke, who speaks of having taken this point as corresponding to that of congelation. It should be observed, however, that his table of alloys shows a variety in the fusing points, which is incompatible with the observations of the committee, supposing the stationary point to have been taken in each case as the fusing point.

The alloys passing gradually from the fluid to the solid state, an attempt was made to seize the more remarkable points, as referred to in the table; but these can only be considered as approximately determined. Direct experiments were, in most cases, made upon the temperature at which the metal refused to allow a metallic stem to be withdrawn. This was the case when the metal, from the state of a soft solid, began to acquire hardness.

TABLE I. *Alloys solidifying between* 486° *and* 355° *Fah.*

Eight parts of Tin to Lead.	Begins to lose fluidity.	Loses fluidity.	Stem draws out.	Falls to.	Stationary.	Eight parts of Tin to Lead.	Begins to lose fluidity.	Loses fluidity.	Stem draws out.	Falls to.	Stationary.	REMARKS.
8	393°	355°			355°	20	492	446	416*	351½	354	* 415°, with temperature rising.
10	430½	375½		354	355	23	521	480	466	352†	353½	† Hard solid, at 426°.
12	445	393	380	352	354	26	529	503	486	‡	353	‡ Hard at 437°.
16	475	439	405	352	354							

The next object was to diminish the relative proportion of lead, so as to determine the most fusible alloy of the two metals. The results obtained will be seen in the following table. The lead was the same in each case; namely, eight parts by weight.

Eight parts of Lead with Tin.	Liquid metal begins to thicken.	Stationary Temperature.	REMARKS.
Parts.	Fah°	Fah.°	
8	364½*	352†	* Began above this point. † In these three cases the alloy congeals in thin plates, at the surface, and is a sandy solid below, at the sides. A liquid, with solid portions, at stationary temperature.
		353†	
		353½†	
9	368½	351	
10		354*	* Hardens in round masses, which, at the stationary point, are surrounded by a liquid.
	366½	352½*	
		352½*	
11		353¾	
12		353	
16		352	

The table of alloys by Parke, before referred to, gives a considerable variation in the melting points of the alloys in the above table. He makes the stationary point of the alloy of eight to eight, 372° Fah.; that of eight lead and ten tin, 352°; that of eight lead to twelve tin, 336°; this latter being the most fusible of the alloys of lead and tin. That the alloy, in equal parts, has not a fusing point varying much from that just given, the committee were able to determine from various specimens of metal. With pure lead and grain tin, they found, for eight lead and nine tin, nearly the same as the foregoing, the stationary point to be, in different experiments, 355¾°, 356°, and 355½°. With one specimen of common lead the stationary point of an alloy of equal parts of lead and tin was 356° Fah. This lead melted at 606°, and the tin at 442½°. The committee have no greater reason to suspect the accuracy of their other results. In all these cases the stationary point occurs when the metal begins to solidify.

It appears, then, by the foregoing table, that very little change is effected in the fusing point of the alloy of equal parts of tin and lead, by increasing the quantity of the more fusible metal. A curious coincidence is shown between the stationary point of these alloys and of those in which the lead is increased. The two intervals, which are best determined in the table, between the temperature at which fluidity begins to be lost, and that at which the metal becomes solid, are seventeen and fourteen degrees. When the lead becomes considerable in quantity, the passage from the fluid to the solid state is by such minute mechanical changes, as to extend through a long series of temperatures. This is even more especially the case when bismuth also enters largely into the alloy; instructive examples of which occur in the following table.

Lead.	Tin.	Bismuth.		
20,	8,	8,	352°	Fused metal begins to lose fluidity.
			307	Soft solid, penetrable.
			279	Stationary point.
22,	8,	8,	358	Fused metal begins to thicken.
			280¾	Stationary.
40,	8,	8,	466½	Begins to thicken.
			368½	Is a soft solid.
			337¾	Hard solid.
			280¼	Stationary point.
44,	8,	8,	474¾	Begins to thicken.
			429¾	Loses fluidity; is a soft solid.
			388¾	Hard solid.
			280½	Stationary.
48,	8,	8,	481	Thickens.
			440	Loses fluidity.
			280½	Stationary.

From perfect solidity to the greatest degree of fluidity of which the alloy was capable, required in the case of the first alloy given above, about seventy degrees of temperature: and between the temperature at which a solid could pierce the alloy, and the stationary temperature, was eight degrees. When the quantity of lead was doubled, the first interval was nearly one hundred and thirty degrees; and the interval between the temperatures of solidity and that at which the alloy could be penetrated easily, was about twenty degrees.

These facts show that in using fusible alloys, those should be preferred which contain the smallest quantities of lead: a similar reason would lead to the preference of those containing the smallest proportions of bismuth.

Tin is nearly liquid at the stationary temperature; hardens by plates or small masses, and becomes entirely solid at this same temperature.

Experiments were made to ascertain what quantity of bismuth could be added to tin without destroying the property just described. To one hundred parts by weight, of tin, one part, five parts and ten parts of bismuth, respectively, were added. The first alloy melted at 439¾°, and had the general characters of tin in hardening; the second melted at 428°, and had these characters impaired; the third had no stationary temperature above four hundred degrees, and lost its fluidity by slow degrees.

As it was thus shown that alloys of tin and bismuth presented no peculiar advantages, the alloys for temperatures below 355°, Fah., were sought by combining the least quantity of bismuth which would give any requisite temperature with one of the alloys of the table on page 37. For this purpose the alloy of equal parts of tin and lead was selected as having appropriate characters in its solidification, and melting at nearly as low a temperature as any of the others in the table. It does not, of course, follow, that this alloy when combined with a given quantity of bismuth, will produce as low a fusing point as some other would; a question which, if it were worth deciding, experiment would determine. A few trials on this head were made by the committee.

The following table gives the proportions of bismuth, which, added to an alloy of eight parts of tin and eight of lead, will give the temperatures of the stationary points of an immersed thermometer between 355° and 326°. With the alloy which terminates this table, the stationary temperature near the fusing point disappears, and another form of table is required for description.

Table II. *Alloys of Tin, Lead, and Bismuth, melting between* 355° *and* 326° *Fah.*

Eight parts, by weight, of Tin, and eight of Lead.						
Bismuth.	Begins to lose fluidity.	Stationary point.	Bismuth.	Begins to lose fluidity.	Stationary point.	REMARKS.
0.0	393°	355°	1.0	362°	339¾°	All these alloys are liquid with solid portions, when the thermometer becomes stationary.
0.2	387	351	1.4	347	335	
0.4	375	349	1.8	343	331	
0.6	369	345¼	2.2	331	326*	* Slow, not stationary.
0.8		342¾				

The stationary temperature having disappeared with the increase of bismuth, the points attempted to be ascertained were these; the temperature at which the metal began to lose fluidity; that at which it ceased to be a liquid, as indicated by the surface not returning to a level when indented; that at which the solid ceased to be penetrable to a small rod by moderate pressure; and when it became hard. As these temperatures present nothing as definite as the stationary temperature, they are, of course, only approximate. A few trials made on the withdrawal of a metallic stem from the alloy, showed that the temperature at which this ceased to be possible was, for the alloys in the following table, between the temperature at which the metal lost its fluidity, and that at which it could not be penetrated by moderate pressure.

Table III. *Alloys losing fluidity between* 313° *and* 246° *Fah.*

Eight parts, by weight, of Tin, and eight of Lead.									
Bismuth.	Begins to lose fluidity.	Begins to solidify.	Solid, not easily penetrated.	Hard, solid.	Bismuth.	Begins to lose fluidity.	Begins to solidify.	Solid, not easily penetrated.	Hard, solid.
2.6	326	313	307	301	5.4	296½	280½	270½	264½*
3.0	321	313		297	6.2	294½	269	261†	246
3.4	316	309	301	295½	7.0	288½	257	252‡	238
3.8	311	306	298½	289½	7.6	283½	253	242§	234
4.6	301	291		271½	8.0	272	246	232‖	226

* Stationary at 205°.
† Stem drew out at 264°.
‡ Stem drew out at 254°.
§ Stem drew out at 245°.
‖ Stem drew out at 235°.

The fusing points of the metals used in the foregoing alloys were, of the tin, 442° Fah., of the bismuth, 506°, of the lead, 612°.

VI. To repeat the experiments of Klaproth, relating to the conversion of water into steam, by highly heated metal.

It being now well understood that an increase of temperature in a metallic surface may diminish the amount of vaporization of a fluid placed upon it, the object of the following experiments was to study the phenomena attending the vaporization of water by iron and copper, under different circumstances.

1st. To ascertain the temperature, at which a given small quantity of water will be vaporized in the least time, by copper, with different states of surface.

2d. To ascertain the same point for iron, in similar circumstances.

3d. To extend these deductions to the effect of introducing different quantities of water into copper or iron vessels, varying in thickness, in character of surface, and heated by different sources, to various temperatures.

A number of bowls, of these different metals, of as nearly the same figure as could be obtained, and of different thicknesses, were provided. The bowls were portions of spheres, of nearly three inches radius, and were eight in number, three being of copper and five of iron; four of these latter were of wrought, and one of cast iron. For applying heat to the bowls, a cylindrical vessel containing oil, and another containing tin, were provided; the former was about nine inches in diameter, and four high, and the latter six and a half inches in diameter and four high. These vessels were heated by Mitchell's* alcohol lamp, or in the very high temperatures, by a charcoal furnace. The bowls were furnished with handles, which projecting, overlapped the edges of the cylinders serving as baths for the oil and tin, and were thus kept in place.

The thermometers used in the experiments, were carefully compared at the boiling point of water, and melting point of pure tin.

The experiments first to be detailed, refer to the vaporization of drops of water in copper bowls of different states of surface, from the smooth polish to the roughness of oxidation.

Vaporization of Drops of Water by Copper.

1. The bowl, No. VII. of copper, seven-hundredths of an inch thick, was polished, but not very highly, and then placed in the tin bath while fluid; the tin, on solidifying, kept the bowl in its place. The thermometer was placed in a small cylinder of thin sheet iron, containing mercury, the cylinder being as near the cup as possible. As the experiments progressed, the surface of the bowl became, of course, more and more tarnished; and after the two series of results recorded below were obtained, a third showed a marked effect from the oxidation, by the increased vaporization. One hundred and twenty drops, nearly, from the tube used, made up one-eighth of a fluid ounce; the weight of one drop was, therefore, about .47 of a grain.

---

* A very convenient alcohol lamp, with a draught through the wick, and a separation between the alcohol reservoir and the wick.—The invention of Dr. J. K. Mitchell.

Smooth surface. Copper bowl .07 inch thick.				
Descending Series.*			Ascending Series.	
Temp.	Drops on Centre.		Drops on Centre.	
Fah.°	Time.	Remarks.	Time.	Remarks.
	Secs.		Secs.	
315.3	5 3	On a polished part. On less polished.		
317.3			3½	
319.3	>2			
321.4	3		3 2½	
323.4			2½	
325.4			2	
327.5	2		1¾	
329.5	2		1½	
331.5			2	
333.6	2½	Not repelled.	2	
335.6			>2	
337.6				On a rough place, 1½ seconds.
339.7		Not repelled.		
341.7		A drop on side of bowl, 12 secs.		
343.8				
345.9				
348				
350	165	Repulsion perfect. Tempera. rising to 360°.		
352				

The temperature of maximum vaporization, under these circumstances, appears to have been between 327½° and 329½° Fah., the two series coinciding nearly in their indications; the repulsion is shown to have been perfect at 350°, the drop falling upon the centre assuming the usual rotary motion, and disappearing very slowly.

2. The surface of this same bowl was next highly polished with rotten stone

---

* In this and other tables, the series marked descending, are those obtained when the temperature was falling; the ascending series were obtained while the temperature of the bath was rising.

and oil, and a similar method of experimenting gave the following results, the same bath being used.

Polished Copper Surface.		
Descending Series.		
Temperature.	Drops on Centre.	
	Time in Secs.	Remarks.
445	210	Perfectly repelled.
370.5	177	Do.
331.6	157	Do.
318.3	25	Repulsion obviously lessened.
313.2	9	Repulsion not perfect.
300	4	
291.6	3½	
”	3	
285.5	4	
284.5	4½	
279.4	5½	
275.4	6½	
271.3	5½	
267.2	6	
255	16½	

(*To be continued.*)

Reply to the Query in regard to the Coating of the Pipes forming the Condenser at the Philadelphia Gas Works.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—Your correspondent, in his query proposed in the last number of this Journal, has fallen upon a disputed point of science; but I will endeavour to furnish the grounds for deciding his question, according to the conflicting authorities.

The object of the pipes, to which he refers, is to condense, in part, the moisture and other easily condensible matters, which come over with the heated gas from the retorts, previous to its entrance into the purifiers, where it circulates in contact with lime. This object is attained by a series of vertical pipes, connected at the top, and passing at the bottom into large boxes, with vertical partitions, not extending quite to the bottom of each box. The gas passes through the pipes and their boxes in succession, circulating from one end to the other of the series, being thus exposed to the cooling action of the metal of the pipes and boxes. In the latter the condensed substances collect, and are removed by suitable openings.

Whatever means, then, will tend to allow the escape of heat from the metal of the condensers, will promote their efficiency. The air without, and the surrounding bodies, are supposed cooler than the gas passing through the pipes, which will be true, except in extraordinary cases.

The heat of the gas will be carried off more rapidly as the exterior surface of the condenser is kept cool. In this case, the surface will be cooled in two ways,—by contact of the air, and by radiation. The air adjacent to the pipes becoming heated, by contact with them, will rise, giving place to cool air; this will, in turn, be heated, and rise, continuing the cooling operation.

Besides this, heat is radiated from the surface of the pipes, which, if not restored by radiation from surrounding bodies, serves also to cool them.

It has been established by careful experiments,* that the nature of the surface of contact of air and a body, the extent of surface remaining the same, has no influence on the cooling produced by the contact of a gas. Therefore, whether the paint upon the condensing pipes was of white lead, or lamp black, or any other material, there would be no difference in the cooling effect by contact.

As to the cooling effect of radiation, there is not such certainty. Doctor Stark, of Edinburgh, has endeavoured to show that black substances radiate better than white ones. He has made a few experiments, directly applicable to the subject, which, as far as they go, warrant this conclusion. If it be correct, the condensers should have been painted black. When the sun is not directly shining upon them, they would radiate better than white. When the sun is upon them, the absorption of heat being greater than it would be if the pipes were white, the cooling effect will be considerably diminished. As, however, the condenser is attached to the north wall of a building which is higher than the pipes, the sun will never reach it, except early in the morning, and late in the afternoon, even at midsummer.

On the contrary, your Journal for November contains an extensive series of experiments, by Prof. A. D. Bache, in which colour does not appear to influence the radiation or absorption of heat unaccompanied by light. The experiments were made† by a similar method to that used by Doct. Stark. One of them, which is to the point now before us, was as follows: A small cylinder, filled with warm water, and allowed to cool in the air, required 817 seconds to cool through forty degrees of Fahrenheit's scale, when coated smoothly with India ink; and 846 seconds when coated with white lead, laid on with gum. The ratio of the times of cooling is 1 to 1.03, or within what is stated to be the limit of error in the method of experimenting. It might very well happen that a small difference in the thickness of the two coatings of white and black paint, would produce more effect than this difference of the radiating powers of white lead and lamp black, supposing them to be as just deduced.

It is now well known that the laws which apply to heat, accompanied by light, do not apply to non-luminous heat; hence, there is no discrepancy between the experiments just adverted to, and those of Franklin, in which is shown the greater effect of black cloth than of white, in absorbing the heat from the sun's rays. According to the conclusions from the experiments of Prof. Bache, *the condensers are correctly coated.* For when the sun is not shining upon the pipes, the white paint radiates heat as well as black would; and when the sun does shine upon them, the white absorbs less of the heat accompanying the light, than black would do. The coating of white paint should be thick to derive the full effect from its radiating power, which increases with the thickness up to a certain point, above which the diminution is very slow. U.

---

* Petit and Dulong, Ann. de Chim. et de Phys., 1817.

† Inquiry into the alleged Influence of Colour on the Radiation of non-luminous Heat, &c., p. 291, vol. xvi. of this Journal.

On *the rights of Patentees, with a letter of Mr. Jefferson on that subject, first published in Niles' Register, and afterwards in the 2d vol. of the Emporium of Arts, new series, p.* 446.

We have had repeated, we might almost say perpetual, occasion to remark upon the claims of patentees to what they denominate the *application* of a machine, or instrument, to certain purposes for which it has not been previously used. We accord with Mr. Jefferson, most fully, in many of his observations on that subject, although we do not go with him to the full extent on certain points, as we believe that there are cases where a machine already used in one manufacture, may be beneficially employed in another; and that a patent may be sustained for so employing it; but in this case the patent must not be for the machine, but for "an improvement in the art" to which it is applied. Thus, for example, if a person can introduce into the silk manufacture any apparatus by which a large proportion of the expense attending the ordinary process is saved, he has *improved the art of manufacturing silk,* although he may not have invented any new machinery, but merely have applied that already known so as to produce decided improvements. If substances had heretofore been pulverized in a mortar by repeated blows of a pestle, and some one was to discover that the same effect might be produced in half the time by a rubbing motion of the same instrument, he would be well entitled to a patent for an improvement in the art of using the pestle and mortar, or rather in the art of pulverizing hard substances by means of the pestle and mortar, but to the instruments themselves he must not make any claim.

There is a very frequent want of discrimination in the applicants for patents as respects the head under which they make their claim to invention or discovery. The objects patentable under the law are "any new or useful art,—machine,—manufacture,—or composition of matter;—or any new and useful improvement in any art,—machine,—manufacture,—or composition of matter, &c." Now all these are different things, and they ought to be designated accordingly in an application for a patent. If velvet had never been made, the making of it would be "a new manufacture" and might be patented as such; the mode of making it, however, must be described, and this might consist entirely in the use of well known machinery.

The letter of Mr. Jefferson was elicited by queries respecting the patent of Oliver Evans, at that time under litigation; but with that question our republication of it has nothing to do. Individually, we are of opinion that Oliver Evans was very hardly dealt by, although we admit that the course adopted by him was in some instances unwise; but of one thing there can be no doubt, namely, that he found the grain mills of this country in a very imperfect state, and that he introduced and perfected those improvements which have rendered them models for the whole civilized world, and that for all he did in this way, his expenditures were greater than his receipts. [*Editor.*

Letter of Mr. Jefferson.

MONTICELLO, Aug. 13th, 1813.

Your letter of August 3d, asking information on the subject of Mr. Oliver Evan's exclusive right to the use of what he calls his Elevators, Conveyers and Hopperboys, has been duly received. My wish to see new inventions encouraged, and old ones brought again into useful notice, has made me regret the circumstances which have followed the expiration of his first patent. I did not expect the retrospection which has been given to the reviving law; for although the second proviso seemed not so clear as it ought to have been, yet it appeared susceptible of a just construction; and the retrospective one being contrary to natural right, it was understood to be a rule of law, that where the words of a statute admit of two constructions, the one just and the other unjust, the former is to be given them. The first proviso takes care of those who had lawfully used Evans' improvements under the first patent; the second was meant for those who had lawfully erected and used them after that patent expired, declaring they "should not be liable to damages therefor." These words may indeed be restrained to uses already past; but as there is parity of reason for those to come, there should be parity of law. Every man should be protected in his lawful acts, and be certain that no ex post facto law shall punish or endamage him for them. But he is endamaged if forbidden to use a machine lawfully erected at considerable expense, unless he will pay a new and unexpected price for it. The proviso says: that he who erected and used lawfully shall not be liable to pay damages; but if the proviso had been omitted would not the law, construed by natural equity, have said the same thing? In truth both provisos are useless. And shall useless provisos, inserted pro majori cautela, only authorize inferences against justice? The sentiment that ex post facto laws are against natural rights is so strong in the United States, that few, if any, of the State Constitutions have failed to proscribe them. The Federal constitution indeed interdicts them in criminal cases only; but they are equally unjust in civil as in criminal cases: and the omission of a caution which would have been right, does not justify the doing what is wrong; nor ought it to be presumed, that the legislature meant to use a phrase in an unjustifiable sense, if by any rules of construction it can be even strained to what is just. The law books abound with similar instances of the care the judges take of the public integrity. Laws moreover abridging the natural rights of the citizen, should be restrained by rigorous constructions within their narrowest limits.

Your letter, however, points to a much broader question, whether what have received from Mr. Evans the new and the proper name of Elevators are of his invention: because, if they are not, his patent gives him no right to obstruct others in the use of what they possessed before. I assume it as a lemma, that it is the invention of the machine itself which is to give a patent right, and not the application of it to any particular purpose of which it is susceptible. If one person invents a knife convenient for pointing our pens, another cannot have a patent right for the same knife to point our pencils. A compass was invented for navigating the sea; another cannot have a patent right for using it to survey land. A machine for thrashing *wheat*, has been invented in Scotland; a second person cannot get a patent right for the same machine to thrash *oats;* a third *rye;* a fourth *peas;* a fifth *clover,* &c. A string of buckets is invented and used for raising water, ore, &c., can a second have a patent right to the same machine for raising wheat, a third oats, a fourth rye, a fifth peas, &c.? The question then whether such a string of buckets was invented first by Oliver Evans, is a mere question of fact in mathematical history. Now turning to such books only as I happen to possess, I find abundant proof that this simple machinery has been in use from time immemorial. Doctor Shaw, who visited Egypt and the Barbary coast in the years 1727—8, 9, in the margin of his map of Egypt, gives us the figure of what he calls a Persian wheel, which is a string of round cups, or buckets, hanging on a pully, over which they revolve, bringing up water from a well, and delivering it into a trough above. He found this used at Cairo, in a well 264 feet deep, which the inhabitants believe to have been a work of the patriarch Joseph. Shaw's Travels, 341, Oxford edition of 1738, in folio, and the Universal History, I, 416, speaking of the manner of watering the high lands in Egypt, says—"Formerly they made use of Archimedes' Screw, thence named the Egyptian Pump; but they now generally use Wheels (Wallowers) which carry a rope or chain of earthen pots, holding about 7 or 8 quarts a piece, and draw the water from the canals. There are besides, a vast number of wells in Egypt, from which the water is drawn in the same manner to water the gardens and fruit-trees; so that it is no exaggeration to say, that there are in Egypt above 200,000 oxen daily employed in this labour." Shaw's name of Persian wheel has been since given more particularly to a wheel with buckets, either fixed or suspended on pins at its periphery. Mortimer's Husbandry, 1, 18, Duhamel, V. Ferguson's Mechanics, plate 13. But his figure, and the verbal description of the Universal History, prove, that the string of buckets is meant under that name. His figure differs from Evans' construction in the circumstance of the buckets being round, and strung through their bottom on a chain; but it is the principle; to wit, a string of buckets, which constitutes the invention, not the form of the buckets, round, square, or hexagon; nor the manner of attaching them, nor the material of the connecting band, whether chain, rope or leather. Vitruvius, L. X. c. 9, describes this machinery as a windlass, on which is a chain descending to the water with vessels of copper attached to it; the windlass, being turned, the chain moving on it will raise the vessels, which, in passing over the windlass, will empty the water they have brought up into a reservoir: and Perault, in his edition of Vitruvius, Paris, 1784, folio, plates, 61, 62, gives us three forms of these water elevators, in one of which the buckets are square, as Mr. Evans' are. Bossut, Histoire des Mathematiques, I. 86, says, "The drum wheel, the wheel with buckets, and the *chapelets*, are hydraulic machines, which come to us from the ancients; but we are ignorant of the time when they began to be put into use." The *chapelets* are the revolving bands of buckets, which Shaw calls the Persian wheel, the moderns a chain pump, and Mr. Evans, elevators. The next of my books, in which I find these elevators, is Wolf's Cours de Mathematiques, I. 370, and plate 1, Paris, 1747—8vo. Here are two forms; in one of them the buckets are square, attached to two chains, passing over a cylinder or wallower at top, and under another at bottom, by which they are made to revolve. It is a nearly exact representation of Evans' elevators. But a more exact one is to be seen in Desaguliar's Experimental Philosophy, II. plate 34. In the Encyclopedie de Diderot et D'Alembert, 8vo. edition de Lausanne, 1st. vol of pipes, connected at the top, and passing at the bottom into large boxes, with vertical partitions, not extending quite to the bottom of each box. The gas passes through the pipes and their boxes in succession, circulating from one end to the other of the series, being thus exposed to the cooling action of the metal of the pipes and boxes. In the latter the condensed substances collect, and are removed by suitable openings.

Whatever means, then, will tend to allow the escape of heat from the metal of the condensers, will promote their efficiency. The air without, and the surrounding bodies, are supposed cooler than the gas passing through the pipes, which will be true, except in extraordinary cases.

The heat of the gas will be carried off more rapidly as the exterior surface of the condenser is kept cool. In this case, the surface will be cooled in two ways,—by contact of the air, and by radiation. The air adjacent to the pipes becoming heated, by contact with them, will rise, giving place to cool air; this will, in turn, be heated, and rise, continuing the cooling operation.

Besides this, heat is radiated from the surface of the pipes, which, if not restored by radiation from surrounding bodies, serves also to cool them.

It has been established by careful experiments,* that the nature of the surface of contact of air and a body, the extent of surface remaining the same, has no influence on the cooling produced by the contact of a gas. Therefore, whether the paint upon the condensing pipes was of white lead, or lamp black, or any other material, there would be no difference in the cooling effect by contact.

As to the cooling effect of radiation, there is not such certainty. Doctor Stark, of Edinburgh, has endeavoured to show that black substances radiate better than white ones. He has made a few experiments, directly applicable to the subject, which, as far as they go, warrant this conclusion. If it be correct, the condensers should have been painted black. When the sun is not directly shining upon them, they would radiate better than white. When the sun is upon them, the absorption of heat being greater than it would be if the pipes were white, the cooling effect will be considerably diminished. As, however, the condenser is attached to the north wall of a building which is higher than the pipes, the sun will never reach it, except early in the morning, and late in the afternoon, even at midsummer.

On the contrary, your Journal for November contains an extensive series of experiments, by Prof. A. D. Bache, in which colour does not appear to influence the radiation or absorption of heat unaccompanied by light. The experiments were made† by a similar method to that used by Doct. Stark. One of them, which is to the point now before us, was as follows: A small cylinder, filled with warm water, and allowed to cool in the air, required 817 seconds to cool through forty degrees of Fahrenheit's scale, when coated smoothly with India ink; and 846 seconds when coated with white lead, laid on with gum. The ratio of the times of cooling is 1 to 1.03, or within what is stated to be the limit of error in the method of experimenting. It might very well happen that a small difference in the thickness of the two coatings of white and black paint, would produce more effect than this difference of the radiating powers of white lead and lamp black, supposing them to be as just deduced.

It is now well known that the laws which apply to heat, accompanied by light, do not apply to non-luminous heat; hence, there is no discrepancy between the experiments just adverted to, and those of Franklin, in which is shown the greater effect of black cloth than of white, in absorbing the heat from the sun's rays. According to the conclusions from the experiments of Prof. Bache, *the condensers are correctly coated.* For when the sun is not shining upon the pipes, the white paint radiates heat as well as black would; and when the sun does shine upon them, the white absorbs less of the heat accompanying the light, than black would do. The coating of white paint should be thick to derive the full effect from its radiating power, which increases with the thickness up to a certain point, above which the diminution is very slow. U.

---

* Petit and Dulong, Ann. de Chim. et de Phys., 1817.

† Inquiry into the alleged Influence of Colour on the Radiation of non-luminous Heat, &c., p. 291, vol. xvi. of this Journal.

On *the rights of Patentees, with a letter of Mr. Jefferson on that subject, first published in Niles' Register, and afterwards in the 2d vol. of the Emporium of Arts, new series, p.* 446.

We have had repeated, we might almost say perpetual, occasion to remark upon the claims of patentees to what they denominate the *application* of a machine, or instrument, to certain purposes for which it has not been previously used. We accord with Mr. Jefferson, most fully, in many of his observations on that subject, although we do not go with him to the full extent on certain points, as we believe that there are cases where a machine already used in one manufacture, may be beneficially employed in another; and that a patent may be sustained for so employing it; but in this case the patent must not be for the machine, but for "an improvement in the art" to which it is applied. Thus, for example, if a person can introduce into the silk manufacture any apparatus by which a large proportion of the expense attending the ordinary process is saved, he has *improved the art of manufacturing silk,* although he may not have invented any new machinery, but merely have applied that already known so as to produce decided improvements. If substances had heretofore been pulverized in a mortar by repeated blows of a pestle, and some one was to discover that the same effect might be produced in half the time by a rubbing motion of the same instrument, he would be well entitled to a patent for an improvement in the art of using the pestle and mortar, or rather in the art of pulverizing hard substances by means of the pestle and mortar, but to the instruments themselves he must not make any claim.

There is a very frequent want of discrimination in the applicants for patents as respects the head under which they make their claim to invention or discovery. The objects patentable under the law are "any new or useful art,—machine,—manufacture,—or composition of matter;—or any new and useful improvement in any art,—machine,—manufacture,—or composition of matter, &c." Now all these are different things, and they ought to be designated accordingly in an application for a patent. If velvet had never been made, the making of it would be "a new manufacture" and might be patented as such; the mode of making it, however, must be described, and this might consist entirely in the use of well known machinery.

The letter of Mr. Jefferson was elicited by queries respecting the patent of Oliver Evans, at that time under litigation; but with that question our republication of it has nothing to do. Individually, we are of opinion that Oliver Evans was very hardly dealt by, although we admit that the course adopted by him was in some instances unwise; but of one thing there can be no doubt, namely, that he found the grain mills of this country in a very imperfect state, and that he introduced and perfected those improvements which have rendered them models for the whole civilized world, and that for all he did in this way, his expenditures were greater than his receipts. [*Editor.*

Letter of Mr. Jefferson.

MONTICELLO, Aug. 13th, 1813.

Your letter of August 3d, asking information on the subject of Mr. Oliver Evan's exclusive right to the use of what he calls his Elevators, Conveyers and Hopperboys, has been duly received. My wish to see new inventions encouraged, and old ones brought again into useful notice, has made me regret the circumstances which have followed the expiration of his first patent. I did not expect the retrospection which has been given to the reviving law; for although the second proviso seemed not so clear as it ought to have been, yet it appeared susceptible of a just construction; and the retrospective one being contrary to natural right, it was understood to be a rule of law, that where the words of a statute admit of two constructions, the one just and the other unjust, the former is to be given them. The first proviso takes care of those who had lawfully used Evans' improvements under the first patent; the second was meant for those who had lawfully erected and used them after that patent expired, declaring they "should not be liable to damages therefor." These words may indeed be restrained to uses already past; but as there is parity of reason for those to come, there should be parity of law. Every man should be protected in his lawful acts, and be certain that no ex post facto law shall punish or endamage him for them. But he is endamaged if forbidden to use a machine lawfully erected at considerable expense, unless he will pay a new and unexpected price for it. The proviso says: that he who erected and used lawfully shall not be liable to pay damages; but if the proviso had been omitted would not the law, construed by natural equity, have said the same thing? In truth both provisos are useless. And shall useless provisos, inserted pro majori cautela, only authorize inferences against justice? The sentiment that ex post facto laws are against natural rights is so strong in the United States, that few, if any, of the State Constitutions have failed to proscribe them. The Federal constitution indeed interdicts them in criminal cases only ; but they are equally unjust in civil as in criminal cases: and the omission of a caution which would have been right, does not justify the doing what is wrong; nor ought it to be presumed, that the legislature meant to use a phrase in an unjustifiable sense, if by any rules of construction it can be even strained to what is just. The law books abound with similar instances of the care the judges take of the public integrity. Laws moreover abridging the natural rights of the citizen, should be restrained by rigorous constructions within their narrowest limits.

Your letter, however, points to a much broader question, whether what have received from Mr. Evans the new and the proper name of Elevators are of his invention: because, if they are not, his patent gives him no right to obstruct others in the use of what they possessed before. I assume it as a lemma, that it is the invention of the machine itself which is to give a patent right, and not the application of it to any particular purpose of which it is susceptible. If one person invents a knife convenient for pointing our pens, another cannot have a patent right for the same knife to point our pencils. A compass was invented for navigating the sea; another cannot have a patent right for using it to survey land. A machine for thrashing *wheat* has been invented in Scotland; a second person cannot get a patent right for the same machine to thrash *oats;* a third *rye;* a fourth *peas;* a fifth *clover,* &c. A string of buckets is invented and used for raising water, ore, &c., can a second have a patent right to the same machine for raising wheat, a third oats, a fourth rye, a fifth peas, &c.? The question then whether such a string of buckets was invented first by Oliver Evans, is a mere question of fact in mathematical history. Now turning to such books only as I happen to possess, I find abundant proof that this simple machinery has been in use from time immemorial. Doctor Shaw, who visited Egypt and the Barbary coast in the years 1727—8, 9, in the margin of his map of Egypt, gives us the figure of what he calls a Persian wheel, which is a string of round cups, or buckets, hanging on a pully, over which they revolve, bringing up water from a well, and delivering it into a trough above. He found this used at Cairo, in a well 264 feet deep, which the inhabitants believe to have been a work of the patriarch Joseph. Shaw's Travels, 341, Oxford edition of 1738, in folio, and the Universal History, I, 416, speaking of the manner of watering the high lands in Egypt, says—"Formerly they made use of Archimedes' Screw, thence named the Egyptian Pump; but they now generally use Wheels (Wallowers) which carry a rope or chain of earthen pots, holding about 7 or 8 quarts a piece, and draw the water from the canals. There are besides, a vast number of wells in Egypt, from which the water is drawn in the same manner to water the gardens and fruit-trees; so that it is no exaggeration to say, that there are in Egypt above 200,000 oxen daily employed in this labour." Shaw's name of Persian wheel has been since given more particularly to a wheel with buckets, either fixed or suspended on pins at its periphery. Mortimer's Husbandry, 1, 18, Duhamel, V. Ferguson's Mechanics, plate 13. But his figure, and the verbal description of the Universal History, prove, that the string of buckets is meant under that name. His figure differs from Evans' construction in the circumstance of the buckets being round, and strung through their bottom on a chain; but it is the principle; to wit, a string of buckets, which constitutes the invention, not the form of the buckets, round, square, or hexagon; nor the manner of attaching them, nor the material of the connecting band, whether chain, rope or leather. Vitruvius, L. X. c. 9, describes this machinery as a windlass, on which is a chain descending to the water with vessels of copper attached to it; the windlass, being turned, the chain moving on it will raise the vessels, which, in passing over the windlass, will empty the water they have brought up into a reservoir: and Perault, in his edition of Vitruvius, Paris, 1784, folio, plates, 61, 62, gives us three forms of these water elevators, in one of which the buckets are square, as Mr. Evans' are. Bossut, Histoire des Mathematiques, I. 86, says, "The drum wheel, the wheel with buckets, and the *chapelets*, are hydraulic machines, which come to us from the ancients; but we are ignorant of the time when they began to be put into use." The *chapelets* are the revolving bands of buckets, which Shaw calls the Persian wheel, the moderns a chain pump, and Mr. Evans, elevators. The next of my books, in which I find these elevators, is Wolf's Cours de Mathematiques, I. 370, and plate 1, Paris, 1747—8vo. Here are two forms; in one of them the buckets are square, attached to two chains, passing over a cylinder or wallower at top, and under another at bottom, by which they are made to revolve. It is a nearly exact representation of Evans' elevators. But a more exact one is to be seen in Desaguliar's Experimental Philosophy, II. plate 34. In the Encyclopedie de Diderot et D'Alembert, 8vo. edition de Lausanne, 1st. vol of plates, in the four subscribed "Hydraulique, noria," is one, where round earthen pots are tied by their collars, between two endless ropes, suspended on a revolving lanthern or wallower; this is said to have been used for raising ore out of a mine. In a book which I do not possess, "L'Architecture Hydraulique de Belidor, the II vol. of which is said [De La Lande's continuation of Montucla's Histoire des Mathematique's, III. 711] to contain a detail of all the pumps, ancient and modern, hydraulic machines, fountains, wells, &c. I have no doubt this Persian wheel, chain pump, chapelets, elevators, by whichever name you choose to call it, will be found in various forms. The last book I have to quote for it, is Prony's Architecture Hydraulique, I. advertisement VII. and secs. 648, 649, in the latter of which passages he observes, that the first idea which occurs for raising water is to lift it in a bucket by hand; when the water lies too deep to be reached by hand, the bucket is suspended by a chain and let down over a pully or windlass; if it be desired to raise a continued stream of water, the simplest means which offers itself to the mind is to attach to an endless chain or cord a number of pots or buckets, so disposed that the chain being suspended on a lanthern or wallower above, and plunged into water below, the buckets may descend and ascend alternately, filling themselves at bottom, and emptying at a certain height above, so as to give a constant stream.—Some years before the date of Mr. Evans' patent, a Mr. Martin of Caroline county, in this state, constructed a drill plough, in which he used the band of buckets for elevating the grain from the box, into the funnel which let them down into the furrows: he had bands with different sets of buckets, adapted to the size of peas, of turnip seed, &c. I have used this machine for sowing benni-seed also, and propose to have a band of buckets for drilling Indian corn, and another for wheat. Is it possible that in doing this I shall infringe Mr. Evans' patent? That I can be debarred of any use to which I might have applied my drill when I bought it, by a patent issued after I bought it?

These verbal descriptions applying so exactly to Mr. Evans' Elevators, and the drawings exhibited to the eye, flash conviction both on reason and the senses that there is nothing new in these elevators but their being strung together by a strap of leather. If this strap of leather be an invention entitling the inventor to a patent right, it can only extend to the strap, and the use of the string of buckets must remain free to be connected by chains, ropes, a strap of hempen girthing, or any other substance except leather; but indeed Mr. Martin had before used the strap of leather.

The screw of Archimedes is as ancient at least as the age of that mathematician, who died more than two thousand years ago. Diodorus Siculus speaks of it, lib. 1, page 21, and lib. 5, page 217, of Steven's edition of 1559, folio, and Vitruvius, X. 11. The cutting of its spiral worm into sections, for conveying flour or grain, seems to have been an invention of Mr. Evans, and to be a fair subject of a patent right, but it cannot take away from others the use of Archimedes' screw, with its perpetual spiral, for any purposes of which it is susceptible.

The Hopperboy is an useful machine, and as far as I know original.

It has been pretended by some (and in England especially) that inventors have a natural and exclusive right to their inventions; and not merely for their own lives, but inheritable to their heirs; and while it is a moot question, whether the origin of any kind of property is derived from nature at all, it would be singular to admit a natural and even an hereditary right to inventions. It is agreed by those who have seriously considered the subject, that no individual has, of natural right, a separate property in an acre of land; for instance, by an universal law, indeed, whatever, whether fixed or movable, belongs to all men equally and in common, is the property for the moment of him who occupies it; but when he relinquishes the occupation the property goes with it. Stable ownership is the gift of social law, and is given late in the progress of society: it would be curious then if an idea, the fugitive fermentation of an individual brain, could of natural right be claimed in exclusive and stable property. If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea; which an individual may exclusively possess as long as he keeps it to himself, but the moment it is divulged, it forces itself into the possession of every one, and the receiver cannot dispossess himself of it. Its peculiar character too is that no one possesses the less because every other possesses the whole of it. He who receives an idea from me receives instruction himself without lessening mine; as he who lights his taper at mine receives light without darkening me. That ideas should freely spread from one to another over the globe for the moral and mutual instruction of man and improvement of his condition, seems to have been peculiarly and benevolently designed by nature when she made them, like fire, expansible over all space, without lessening their density in any point; and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation. Inventions then cannot in nature be a subject of property. Society may give an exclusive right to the profits arising from them as an encouragement to men to pursue ideas which may produce utility. But this may or may not be done according to the will and convenience of the society, without claim or complaint from any body. Accordingly it is a fact, as far as I am informed, that England was, until we copied her, the only country on earth which ever, by a general law, gave a legal right to the exclusive use of an idea. In some other countries it is sometimes done in a great case and by a special and personal act; but generally speaking other nations have thought that these monopolies produce more embarrassment than advantage to society; and it may be observed that the nations which refuse monopolies of inventions are as fruitful as England in new and useful devices.

Considering the exclusive right to invention as given, not of natural right but for the benefit of society, I know well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent and those which are not. As a member of the patent board for several years, while the law authorised a board to grant or refuse patents, I saw with what slow progress a system of general rules could be matured. Some however were established by that board. One of these was, that a machine of which we were possessed, might be applied by every man to any use of which it is susceptible, and that this right ought not to be taken from him and given to a monopolist, because he first, perhaps, had occasion so to apply it. Thus a screw for crushing plaster might be employed for crushing corn cobs; and a chain pump for raising water might be used for raising wheat—this being merely a change of application.—Another rule was, that a change of material, should not give title to a patent; as the making a plough share of cast rather than wrought iron; a comb of iron instead of horn or of ivory; or the connecting of buckets by a band of leather rather than of hemp or iron. A third was, that a mere change of form, should give no right to a patent; as a high quartered shoe instead of a low one, a round hat instead of a three square, or a square bucket instead of a round one; but for this rule, all the changes of fashion in dress, would have been under the tax of patentees. These were among the rules which the uniform decisions of the board had already established: and under each of them Mr. Evans' patent would have been refused. 1st, because it was a mere change of application of the chain pump from raising water, to raise wheat. 2d, Because the using a leathern instead of a hempen band, was a mere change of material: and 3dly, square buckets instead of round, are only a change of form; and the ancient forms too, appear to have been indifferently square or round. But there were still abundance of cases which could not be brought under rule until they should have presented themselves under all their aspects; and these investigations occupying more time of the members of the board, than they could spare from higher duties, the whole was turned over to the judiciary, to be matured in a system under which every one might know when his actions were safe and lawful. Instead of refusing a patent in the first instance, as the board was authorized to do, the patent now issues of course subject to be declared void on such principles as should be established by the courts of law. This business however is but little analogous to their course of reading, since we might in vain turn over all the lubberly volumes of the law, to find a single ray which would lighten the path of the mechanic or mathematician; it is more within the information of a board of academical professors, and a previous refusal of a patent would better guard our citizens against harrassment by law suits. But England had given it to her judges, and the usual predominancy of her example carried it to ours.

It happened that I had myself a mill built in the interval between Mr. Evan's first and second patents. I was living in Washington, and left the construction of the mill entirely to the mill-wright. I did not even know he had erected elevators, conveyors and hopperboys, until I learnt it by an application, from Mr. Evans' agent for the patent price. Although I had no idea he had a right to it by law (for no judicial decision had then been given) yet I did not hesitate to remit to Mr. Evans the old and moderate patent price, which was what he then asked, from a wish to encourage even the useful revival of ancient inventions. But I then expressed my opinion of the law, in a letter either to Mr. Evans or to his agent.

I have thus, sir, at your request, given you the facts and ideas which occur to me on the subject. I have done it without reserve, although I have not the pleasure of knowing you personally. In thus frankly committing myself to you, I trust you will feel it as a point of honour and candour to make no use of my letter, which might bring disquietude on myself;* and particularly I should be unwilling to be brought into any difference with Mr. Evans, whom, however, I believe to be too reasonable to take offence at an honest difference of opinion. I esteem him much, and sincerely wish him wealth and honour. I deem him a valuable citizen of uncommon ingenuity and usefulness; and had I not esteemed still more the establishment of sound principles, I should now have been silent. If any of the matter I have offered can promote that object, I have no objection to its being so used. If it offers nothing new, it will of course not be used at all.

---

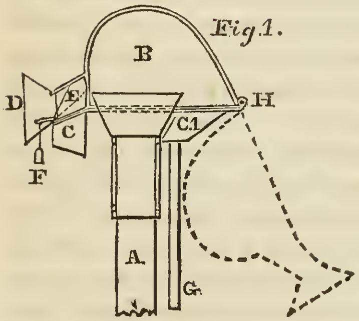
*It is proper to observe, that though the author did not at the time of writing this letter, contemplate its publication, yet his permission has since been obtained.

I have gone with some minuteness into the mathematical history of the elevator, because it belongs to a branch of science, in which, as I have before observed, it is not incumbent on lawyers to be learned; and it is possible, therefore, that some of the proofs I have quoted, may have escaped on their former arguments.

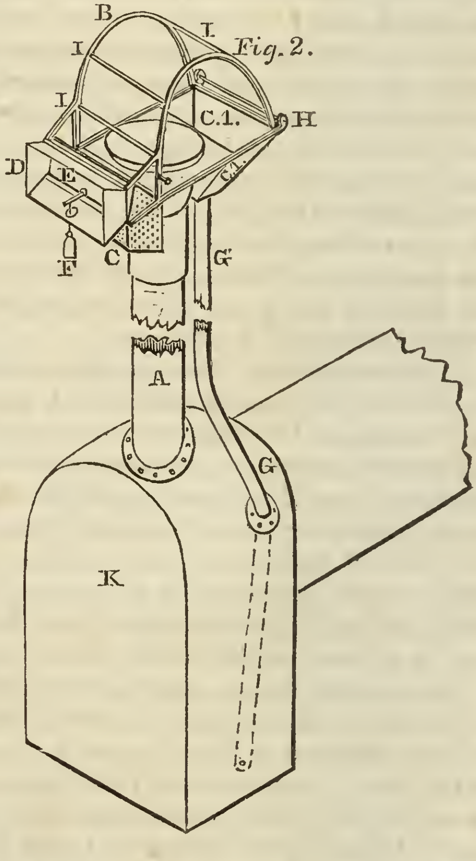
On the law of the subject I should not have touched, because more familiar to those who have already discussed it, but I wished to state my own view of it merely in justification of myself; my name and approbation being subscribed to the act. With these explanations accept the assurances of my respect.
Thomas Jefferson.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of the Patent Spark Arrester, for Locomotive Engines using Wood. By A. C. Jones, *Engineer.*



A, the smoke pipe.
B, cap.
C C, receptacle for sparks, or cinders.
D, funnel.
E, valve or shutter; the dotted lines show it open.
F, counterbalance to shutter.
G, pipe to convey the sparks to the bottom of smoke chamber.
H, hinges to admit of the cap being turned over, as shown in fig. 1.
I, cross bars.
K, smoke chamber.
L, pin to turn the cap.



The advantages of the above represented cap over others that have been tried, are as follows: By making the front open, cold air is forced in by the speed of the engine; this, mixing with the smoke and vapour, cools it, and thereby prevents the gauze from being burnt; (on one engine the gauze has been in use nine months, and remains good at the present time.) The sparks and cinders being conveyed by the pipe, G, to the bottom of the smoke chamber, out of the influence of the flues, are there consumed; there is consequently, no trouble in cleaning the cap on the journey. By making the cap with hinge joints, the clogging of the gauze by lamp-black is prevented, it not being necessary to turn the cap over the pipe, until the train is ready to start. The facility with which the cap can be taken off, for the purpose of cleaning, or to repair, is of some importance. In running backwards, the movable shutter closes the opening in front, and the sparks pass into the perforated box, and are consumed.

When the cap is in use, it is held down by a catch, which is released when the cap is to be turned off, as represented by the dotted lines, fig. 1.

The wire gauze is secured in its place by being clamped between the ribs of iron, and the frame.

After the experience of more than nine months with this plan of spark arrester, on three different constructions of locomotive engines, (and all with the same success,) I do not hesitate to say that the draught is not injured by the use of the cap.

Certificates.

Mr. A. C. Jones' spark arrester has been in use on the Portsmouth and Roanoke Rail-road, for about two months. It answers the purpose for which it was intended, and which its name indicates, better than any thing of the kind which I have seen. Since the use of Mr. Jones' machine, passengers are not at all annoyed by sparks, and a very slight covering is sufficient protection to the most combustible material (cotton in bales) which is transported on the road.

Walter Gwynn, *Civil Engineer.*

I fully concur with Mr. Gwynn in recommending the invention of Mr. Jones, as the best which I have seen, and least likely to affect unfavourably the draught of the furnace of the engine. Arthur Emerson,
President of the Portsmouth and Roanoke Rail-road Co.
Portsmouth, October 17, 1835.

Communications relating to the spark arrester, (post paid,) directed to Thomas C. Garrison, or A. C. Jones, Portsmouth, Va., will be promptly attended to.

Civil Engineering.

Report in relation to a proposed rail-road from the River Ohio to the Tide Waters of the Carolinas.

The committee to whom was referred the subject of a rail-road from the Valley of the Ohio river to the maritime coast of the Carolinas and Georgia, having in a general manner considered its practicability and advantages, beg leave to submit the following

REPORT.

The states which border on the Ohio, or are watered by its great tributary streams, are western or tramontane Pennsylvania and Virginia, Ohio, Indiana, Illinois, Kentucky, and Tennessee; nearly through the centre of which that river flows, almost parallel with the sea coast of the old southern states. From the seven states above mentioned, there are highways of communication with the ocean in but two directions—north-east, and south-west. The former, consisting of several distinct lines of river, canal, macadamized and rail-road communication, reaches the Atlantic ocean between the west end of Long Island Sound and the mouth of the Chesapeake Bay—from New York to Norfolk—a distance, on a straight line, of 300 miles: The latter communicates with the Gulf of Mexico by the delta of the Mississippi. Between these two points of marine connection with the interior, is a coast nearly 3000 miles in extent, constituting the sea-board of southern Virginia, North and South Carolina, Georgia, Florida, Alabama, and Mississippi, with which the states in the Valley of the Ohio have no direct communication, even by means of a good post-road, so that the mail to the northern frontier of Georgia and the Carolinas, not three hundred miles distant from the banks of the Ohio, in a straight line, is actually sent by Washington City, on a route nearly four times as long. With that part of the southern coast which lies west of the peninsula of Florida, the Ohio states have ready intercourse, by the Mississippi river; but with the region east of that peninsula, they are destitute of all adequate means of commercial and social connection. Here then is a great *desideratum*, which can be supplied in no other manner than by the contemplated RAIL-ROAD.

Starting, perhaps from more than one point on the Ohio river, in the state of Kentucky, this road should stretch nearly south; and branching, when it enters the Carolinas and Georgia, to reach their tide-waters at several different places. Taking Cincinnati as a city intermediate between Maysville and Louisville, and Charleston as intermediate between Wilmington, in North Carolina, and Augusta, in Georgia, the road might be said, more especially, to connect Cincinnati and Charleston, and may for convenience in this report, take its length and designation from those cities. Starting from the former, or rather, from the opposite bank of the Ohio river, in Newport or Covington, it would traverse the state of Kentucky to the Cumberland Gap, near the south-western angle of the state of Virginia, then cross the state of Tennessee, and, ascending the valley of the French Broad, in North Carolina, arrive at Greenville, or some other point, in South Carolina, beyond the Allegheny mountains, whence it may pass down to Augusta, in Georgia, by one branch, and by another more immediately to Charleston, in the direction of Columbia. In traversing North Carolina, it might with facility, the surface of the country permitting, be connected by a lateral road, with the projected Cape Fear and Yadkin rail-way, which passing through Fayetteville, is to terminate at Beaty's Ford, on the Catawba river.

The distance between Cincinnati and Charleston, on a straight line, is about 500, which would probably require a road of 700 miles. South Carolina, however, has already made a railway, 135 miles in length, to Hamburgh, on the Savannah river, opposite Augusta, nearly in the direction of Cincinnati; and the contemplated rail-road to Paris, in Bourbon county, Kentucky, exactly in the course of Charleston, (for the construction of which there are, in the opinion of your committee, a great many weighty reasons of a local nature,) would have a length of about 90 miles, thus leaving but 475 miles to complete this new and most important communication, between the interior and the sea-board of the south.

The middle of this main trunk would be intersected by the projected rail-road from Richmond, Virginia, *via* Lynchburg, to Knoxville, in east Tennessee, by which the Old Dominion would acquire a new channel of intercourse with her daughter Kentucky; and also with several of the states formed out of the North-Western Territory, which was once her property,—travelling from the West to southern Virginia, being thus restored to the route which it took in the infancy of our settlements.

By an extension west, to Nashville, of the Richmond, Lynchburg and

Knoxville road, the whole of central and northern Tennessee would be enabled, with great facility, to communicate with the Carolinas and Georgia, by means of the southern extremity, and with the state of Ohio, by means of the northern extremity of the great highway under consideration.

From the maritime terminations, and the lateral branches of this extended trunk, let us turn our attention to the northern or continental connections which it would establish.

These would extend, both east and west, from Cincinnati, for several hundred miles, and through every intervening northern point. First, the Ohio river would connect it with western Virginia and western Pennsylvania —embracing the valleys of the Great Kenhawa, Monongahela and Allegheny rivers: Second, the Ohio and Erie canal, from Portsmouth to Cleveland, already finished ; the Miami and Maumee canal, in progress from Cincinnati to Lake Erie, uniting at Fort Wayne with the Erie and Wabash canal of Indiana; and the Mad-river and Sandusky rail-road, from Dayton to the Lake, the execution of which has commenced, would connect it with the entire chain of northern lakes, from the falls of Niagara to the Straits of Mackinac, and even Green Bay, on the western shore of Lake Michigan, including the eastern border of Wisconsin Territory, north or maritime Illinois and Indiana, the whole of Michigan Territory, a part of Upper Canada, and the centre and northern declivity of Ohio: Third, the Wabash and Erie canal just mentioned, and the rail road from Lawrenceburg, at the mouth of the Great Miami, to Indianapolis, already begun, would carry its advantages into the depths of Indiana: Fourth, the Ohio river from Cincinnati to the Mississippi would connect it, beneficially, with south and west Illinois, Missouri, and the immense extent of unsettled territory watered by the upper Mississippi and Missouri rivers. Thus the proposed main trunk, from Cincinnati to Charleston, would resemble an immense horizontal tree extending its roots through, or into, ten states, and a vast expanse of uninhabited territory, in the northern interior of the Union, while its branches would wind through half as many populous states on the southern sea-board.

The extent of this inland communication from north to south, through the centre of the United States, would comprehend at least 15° of latitude, and could only be compared with that established by the Mississippi river. It would not indeed be limited by the continent, for, as many important islands of the West Indies are contiguous to South Carolina, *they* would, in fact, be comprehended in the new facilities of intercourse that would be established between the south and north, and should, therefore, be taken into the estimate.

Of the physical practicability of constructing the main trunk of the proposed rail-way, across the states of Kentucky, Tennessee, and North Carolina, your committee see no reason to entertain a doubt. It is true, that it must traverse many of the branches of the Cumberland and Tennessee rivers, and scale the southern extremities of the Allegheny mountains. One of the branches, however, of the latter river, the French Broad, as we have already seen, originating on the slopes of the Blue Ridge, the most southern of the mountain chains, runs to the north, traversing the western angle of North Carolina, to unite with the Tennessee, thus opening a pass through a part of the mountains, and inviting to the enterprize. Of the height of the remaining mountains, your committee cannot speak with confidence, but believe it to be less than that of the Alleghenies, where they are traversed by the rail-road and canals from Philadelphia to Pittsburg. However this may be, no decision of the question of physical practicability can be made, but by competent engineers, on an actual examination of the route.

The question of expense can of course only be settled by the same means. Assuming that the projected rail-road from the Ohio river, opposite Cincinnati, to Paris, in Bourbon county, Kentucky, will, from the considerations limited to the region of country concerned, be most certainly executed, and referring to the actual completion of the rail-road from Charleston to Augusta, the intervening section would not, as we have seen, exceed 475 miles, which, at the high price of 12,500 dollars per mile, would amount to 6,000,000 of dollars; a sum not greater than is about to be expended by a company of capitalists, in the construction of a rail-way within the state of New York, to run nearly parallel with her grand canal, and connect the same waters with the same city.

It may be said, however, that the central part of the Cincinnati and Charleston road would run through a country but thinly inhabited, and furnishing little aid, either in the construction of the road or in swelling the amount of transportation upon it. But why *is* it so sparsely peopled? Manifestly, in part, because of all portions of our common country, it is the most inaccessible and the most destitute of facilities for the exportation of its iron, salt, coal, tar, turpentine, and other natural productions. To wait, therefore, for a denser population, as a condition for commencing a great work of internal improvement, which only can augment that density, would be to wait for the development of an effect, before resorting to the only cause that can produce it. Let the road be executed, and an instantaneous impulse will be given to improvement in that region. If, however, it were too sterile for such a result to occur, no argument against the project could arise from that fact, for the undertaking is necessary to the reciprocal exchange of the production of the states penetrated by its extremities, in which respect it would be similar to the Philadelphia and Pittsburg route, which, in a part of its course, passes over uninhabited mountains, and still facilitates an immense trade between the east and west.

Thus it is not necessary that the whole line of an artificial way should lie through a cultivated and populous country, nor need we look to the inhabitants along this or any other projected rail-road or canal, for the means of its construction. These will be furnished by the capitalists of any and every part of the country, or even by those of Europe, the moment the enterprize is authorized by the states through which it is to be carried on, and the probabilities of a profitable investment are rendered manifest. In the opinion of your committee, the states of Kentucky, Tennessee, and the Carolinas, might, in their sovereign capacity, execute this work, and make it a rich and lasting source of revenue; and, they have as little doubt, that the incorporated joint stock companies would at once be able to command the requisite capital.

Your committee are of opinion, that the strongest motives exist for the immediate execution of this great work. At least half the people of the Union, comprehending, in whole or in part, in East Florida, Georgia, South Carolina, North Carolina, Virginia, Pennsylvania, Tennessee, Ohio, Michigan, Indiana, Illinois and Missouri, are interested in its completion, as they would instantly participate in its advantages; and, as your committee believe, need only to investigate the subject, to be at once aroused to efficient action.

Would it pass, like the New York canal, or the projected rail-road from Augusta, in Georgia, to Memphis, in Tennessee, nearly from east to west, and consequently combine regions which have similar climates, and identical productions, its value would be far less. But, as we have seen, stretching boldly from north to south, and, with the present and future public works of the states between the Ohio river and the lakes, establishing a high road of communication through nearly all the climates and varieties of soil, productions, and people of the United States, it would forever stand alone and conspicuous among the public works of the Union, both in the kind and amount of commercial and social intercourse which it would promote.

The sustenance and manufactures of the corn states, from Kentucky to Michigan, would instantly pass along it to the southern consumer, of the region from Cape Florida to the Chesapeake Bay, avoiding all the delays, commissions, dangers of the river, and dangers and damages of a tropical sea voyage which belong to the Mississippi and Gulf route; and even much of the produce that might be designed for coasting or foreign exportation, would reach the sea-ports of South Carolina and Georgia, by the same channel, instead of going to New Orleans or New York. On the other hand, the tropical productions of the north-east of Cuba, and of East Florida—their spices, sugar, oranges, lemons, and figs;—and the indigo, rice and cotton of Georgia and Carolina would, by the same direct route, penetrate, in a few days, the interior of the continent, and spread among the consumers, even to the shores of Lake Superior.

Some of your committee, indeed, incline to the belief, that the same channel would, at no distant time, become an inlet for many of the productions and manufactures of foreign countries; for commerce, as far as possible, should be based upon a *direct* exchange of productions and commodities. Thus the shipping merchants of Charleston and Savannah, might barter their cotton in Europe for manufactures required by the people of the states in the Valley of the Ohio, and exchange the same for their sustenance; the whole operation, both continental and marine, being performed without the instrumentality of any other money than that employed in defraying the expenses of transportation.

Of the *amount* of the business that would, at length, be conducted on this national high-way, the committee scarcely dare to speak. To them it appears of a magnitude, which they fear the meeting and the community at the *present time* would regard as extravagant and incredible. By the existing population of the portions of country, even now connected with the work, there would be a great amount of traveling and transportation; but the extent to which it would augment the population of the zone of country through which it would pass; the impulse to agriculture it would impart; the manufacturing establishments it would set up, and the lateral turnpikes, rail roads and canals it would suggest, to new districts of country, from the western slopes of the Allegheny mountains to the banks of the Mississippi, from the sea to the lakes, would make it the parent of a great system of central internal improvement, and enable it to augment the amount of its articles of transportation to an indefinite degree. These immense pecuniary benefits, accruing to millions of people, should, of themselves, prompt those who are interested to an immediate attention to the work; but there are other and nobler considerations, which should not be overlooked.

No public work could contribute more powerfully to our national defence. Establishing a direct and rapid communication, between the northern and southern frontiers of the United States, separated, unlike the eastern and western, from the dominions of foreign nations by narrow sheets of water only, it would afford facilities for the transportation of troops, munitions of war, and military sustenance, from the centre to the borders, or even from one frontier to the other, with unexampled rapidity; thus favour-ing a concentration, requisite to national defence in time of war, which could not otherwise be effected; and which would present a new triumph of civilization over barbarism, by making civil public works, an efficient substitute for standing armies and powerful navies, which exhaust the resources and endanger the liberties of a nation.

But the most interesting and affecting consequence that would flow from the execution of this enterprise, would be the social and political.

What is now the amount of personal intercourse between the millions of American fellow citizens of North Carolina, South Carolina, and Georgia, on the one hand, and Kentucky, Ohio, Indiana, and Illinois, on the other? Do they not live and die in ignorance of each other; and, perhaps, with wrong opinions and prejudices, which the intercourse of a few years would annihilate forever? Should this work be executed, the personal communication between the north and south would instantly become unprecedented in the United States. Louisville and Augusta would be brought into social intercourse; Cincinnati and Charleston be neighbours; and parties of pleasure start from the banks of the Savannah for those of the Ohio river. The people of the two great valleys would, in the summer, meet in the intervening mountain region of North Carolina and Tennessee, one of the most delightful climates in the United States; exchange their opinions, compare their sentiments, and blend their feelings—the north and the south would, in fact, shake hands with each other, yield up their social and political hostility, pledge themselves to common national interests, and part as friends and brethren.

Finally, the immense summer throng of visitors which annually go up to the north, along the sea-board, would be made still greater, and turning westwardly through the states of Virginia, Maryland, Pennsylvania, and New York, spread over the northern centre of the United States, to the shores of the lakes and upper Mississippi; concentrating on their return in the Valley of the Ohio; having seen what they now never see, and made acquaintance with what at present is unknown to them, the very heart of the Republic. On the other hand, the people of the north would, in autumn and winter, pour down upon the temperate plains of the south, in turn, studying their political, civil, and literary institutions, participating in their warm hospitality, catching a glow of southern feeling, gratifying their curiosity, and return enlarged in their patriotism and enriched in their knowledge of our common country. Thus this traveling, alone, would, at no distant day, reimburse the expenditures by which it might be created, while it would unite with the ties of business, in confining with a new girdle, states which are now but loosely connected, and thereby contribute powerfully to the perpetuity and happiness of the Union.

Danl. Drake,
T. W. Bakewell, } Committee.
Jno. S. Williams,

Cincinnati, Aug. 15, 1835.

Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Historical notice of a Hypothesis to explain the greater quantity of rain which falls at the surface of the ground than above it. By A. D. Bache, *Prof. of Nat. Philos. and Chem. Univ. Penn.*

In the report of Prof. Phillips, of King's College, London, on the relative quantities of rain collected at different heights, the following hypothesis is offered, as deduced from his observations.

"So remarkable and continued an accordance between the co-efficients fixed by observation and those derived by two methods from a very simple view of the condition of the air as to heat and moisture, appears to me decisive of the question as to the general cause of the variation of the quantity of diminution of rain at any one height above the ground. It has already been shown how strictly the observations warrant the conclusion that the ratio of diminution at different heights is constant throughout the whole year. It is therefore rather as a matter of very probable inference than a plausible speculation that I offer the hypothesis, that the whole difference in the quantity of rain, at different heights above the surface of the neighbouring ground, is caused by the continued augmentation of each drop of rain from the commencement to the end of its descent, as it traverses successively the humid strata of air at a temperature so much lower than that of the surrounding medium, as to cause the deposition of moisture upon its surface." [Third Report of British Assoc. page 410.]

The fact that a less quantity of rain is received by a rain guage upon an elevation than upon the subjacent ground, was proved about the year 1766 by the experiments of Dr. Heberden, Lord Cavendish, and others. The hypothesis now advanced by Prof. Phillips, was suggested about 1771 as an explanation of their curious results by Dr. Franklin, and he is not the less entitled to the credit of originating it that after fully considering the subject he cautiously concluded, that the then state of knowledge of it was hardly ripe for making *any hypothesis.* "I think we want more and a greater variety of experiments in different circumstances, to enable us to form a thoroughly satisfactory hypothesis." His remarks contained in a letter to Dr. Percival, who has also written on the subject, were first published in the Manchester Memoirs for 1784. The following is Dr. Franklin's view of the matter:

"I suppose it will be generally allowed, on a little consideration of the subject, that scarce any drop of water was, when it began to fall from the clouds, of a magnitude equal to that it has acquired, when it arrives at the earth; the same of the several pieces of hail; because they are often so large and so weighty, that we cannot conceive a possibility of their being suspended in the air, and remaining at rest there, for any time, how small soever; nor do we conceive any means of forming them so large, before they set out to fall. It seems then, that each beginning drop, and particle of hail, receives continued addition in its progress downwards. This may be in several ways; by the union of numbers in their course, so that what was at first only descending mist becomes a shower; or by each particle, in its descent through air that contains a great quantity of dissolved water, striking against, attaching to itself and carrying down with it such particles of that dissolved water, as happen to be in its way; or attracting to itself such as do not lie directly in its course by its different state, with regard either to common or electric fire, or by all these causes united.

"In the first case, by the uniting of numbers, larger drops might be made, but the quantity falling in the same place would be the same at all heights; unless, as you mention, the whole should be contracted in falling, the lines described by all the drops converging, so that what set out to fall from a cloud of many thousand acres, should reach the earth in perhaps a third of that extent, of which I somewhat doubt. In the other cases we have two experiments.

"1. A dry glass bottle filled with very cold water, in a warm day, will presently collect from the seemingly dry air that surrounds it a quantity of water, that shall cover its surface and run down its sides, which perhaps is done by the power wherewith the cold water attracts the fluid, common fire, that had been united with the dissolved water in the air, and drawing the fire through the glass into itself, leaves the water on the outside.

"2. An electrified body left in a room for some time will be more covered with dust than other bodies in the same room not electrified, which dust seems to be attracted from the circumambient air.

"Now we know that the rain, even in our hottest days, comes from a very cold region. Its falling sometimes in the form of ice, shows this clearly; and perhaps even the rain is snow or ice when it first moves downwards, though thawed in falling: and we know that the drops of rain are often electrified: but those causes of addition to each drop of water, or piece of hail, one would think could not long continue to produce the same effect; since the air, through which the drops fall, must soon be stripped of its previously dissolved water, so as to be no longer capable of augmenting them. Indeed very heavy showers, of either, are never of long continuance, but moderate rains often continue so long as to puzzle this hypothesis; so that upon the whole, I think, as I intimated before, that we are yet hardly ripe for making one."

In investigating a complex subject of this kind, the experimenter not unfrequently proceeds as if it were entirely new, and to this cause I attribute the fact that Prof. Phillips was not aware that he had been anticipated in his hypothesis. The demonstration of the hypothesis, if it is considered conclusive is sufficient distinction, and belongs to a more advanced state of science than that of which the eighteenth century could boast. The credit of *originating it* we should abandon.

December, 1835.

Notice of Tide Observations in the United States. By a Correspondent.

TO THE COMMITTEE ON PUBLICATIONS.

In the American Almanac for the year 1836, of which there is a very favourable and just notice in the January number of the Journal of the Institute, occurs the following paragraph, from the pen of the editor of the astronomical department.

"It may be proper to remark that notwithstanding the three corrections abovementioned, the computed time of high water frequently in calm weather, differs considerably, perhaps half an hour, from the computed. Indeed, until recently, astronomers seem to have been contented with the knowledge that the flow and ebb of the sea were caused by the attraction of the sun and moon, and to have taken little pains to increase their acquaintance with these curious and interesting phenomena. But as, within a short time, much attention has been turned to the subject, and many competent persons in Europe have undertaken to make careful observations for a series of years, on every tide, we are induced to hope that the causes of some of the anomalies, not only in the time of high water, but also in the rise of the tide, may be discovered, and their effects predicted. It is a source of deep regret that these European savans will not, probably, find any co-labourer in this country. Possessed, as we are, of an immense coast, and the second commercial nation on earth, it would seem that an accurate knowledge of the causes of the tides would be, unto us, of the highest importance; but there is too much reason to fear we shall do no more to advance this great work, than we have done for astronomy in general, viz: to declare ourselves the most enlightened people ever in existence, to fold our arms, and continue to be indebted to the noble nation from which we are descended, for their Nautical Almanac, without which, hardly an American vessel would go to sea."

Now, here is a severe charge by an American editor, which ought only to have been made, if made at all in such a work, after full inquiry into the facts of the case. "There is too much reason to fear that we shall do no more to advance this great work, than we have done for astronomy in general." Whatever reproach must lie at our door for the neglect of astronomy in general, we are blameless in regard to the branch relating particularly to the tides, at least as far as observation goes. Inquiry would have shown that an extensive series of tide observations were made along the line of our Atlantic coast, in June last, under the direction of the commander-in-chief of the United States' army, and by request made to the Executive of the United States, by a branch of the government of Great Britain. We ought, perhaps, before this, to have had in some one of our journals at least a general account of these observations. The execution of the task without any accompanying boast will serve, however, to illustrate the disinterestedness of the motive which prompted the undertaking, while the nature of the undertaking itself vouches for some share of scientific zeal.

An acknowledgment for these promised observations was made by the Rev. Mr. Whewell, at the meeting of the British Association for the Advancement of Science, in August last. D.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Review of a "Geological Report of an Examination, made in 1834, *of the Elevated Country between the Missouri and Red rivers. By G. W. Featherstonhaugh, U. S. Geologist.** *Published by order of both Houses of Congress. Washington: Printed by Gales & Seaton.* 1835."

In the present age of utilitarianism, the value of scientific knowledge is very generally and very properly appreciated, by the benefits which result from its practical application to the ordinary pursuits of life; and there is no science which, when tried by this test, ranks higher in the scale of utility than geology. Its existence is, indeed, of recent date, but it has already afforded more real and useful information respecting the structure of the planet we inhabit, and the position of its mineral treasures, than had been acquired in all the previous ages of the existence of the human race. It was, therefore, to be expected, that both governments and individuals would be eager to avail themselves of the facilities presented by this science, and to apply them to the investigation of those subterranean sources of wealth, which are so influential in the promotion of national prosperity. The spirit of enterprise, so characteristic of the American people, was promptly directed to so attractive an object; and different geological surveys have been made, the results of which have been in the highest degree beneficial to the interests of the country. The state of North Carolina may be said to have taken the lead in this career of utility; and the zeal of Massachusetts in the same cause has been rendered eminently conspicuous by the full and able report of her geologist, Prof. Hitchcock. These examples have been followed by the general government, and those of the states of New Jersey, Virginia, Maryland, and Tennessee. Different gentlemen have been employed by these authorities to make geological investigations of states, or districts, and several of their reports have been made and published; some portion, therefore, of information on this important subject, has been very generally diffused. It must not, however, be concealed that there is some danger of our being led into error by these attempts to circulate knowledge; for, unless the persons selected to make these surveys are eminently qualified for the task, and discharge it with judgment and caution, erroneous opinions may be promulgated, and results proportionably disastrous will be the consequence; for, as the statements thus made are brought forward under the stamp of a certain degree of personal and official authority, they may, perhaps, frequently obtain more credit than is due to their intrinsic merit.

---

* Whence this title is derived, or by whom conferred, we are uninformed. Geological surveys have been made in England, and in France, but we have never met with the title of "Geologist of England," or "Geologist of France."

I have been led to these considerations by the perusal of the report lately made to the general government by Mr. Featherstonhaugh, the gentleman employed by it to make geological researches in some of its territories, upon which I purpose to offer some brief remarks. In the copy of the instructions of the Topographical Bureau, prefixed by Mr. F. to his report, we find that he was directed "personally to inspect the mineralogical and geological character of the highlands and water sheds, in the elevated country lying between the Missouri and Red rivers, where the public lands are situated," and to state whatever geological information he might possess, which might aid in developing the resources of said country." Under the authority, probably, of the requisition contained in the latter part of these instructions, or, as he himself states, to make his report as permanently instructive as possible, and *transparent to the intelligence of all*, (see p. 6 of the report,) he has thought proper to commence it with a geological essay, which occupies about one-half of the work. The propriety, in any case, of thus swelling out a report, is very questionable, for it distracts the attention from the main object of the work, and, unless it is exceedingly well executed, it does not communicate either instruction or information to the parties whom it is intended to profit. Professor Hitchcock had indeed set the example, in his report on the geology of Massachusetts; but it may be doubted whether, by so doing, he has not sacrificed what ought to have been the main object of his undertaking, viz: the communication to the great body of the people of his state, in language so free from technicalities as to be generally intelligible, a plain statement of its resources and mineral wealth. This error, however, if it be one, is, in a great measure, compensated for by the character of the report itself, which may vie with any geological work extant, in the accuracy of its scientific details, and the fidelity of their topical application. The same cannot, I think, be said of the essay of the U. S. Geologist, which is not only somewhat unsatisfactory in its matter, but also very generally expressed in language, which, so far from being *transparent to the intelligence* of the uninitiated, must, in a great measure, be unintelligible, even to those who are more intimately acquainted with the subject.

It would be an ungrateful and invidious task to point out all the passages in this work which seem liable to these objections; I must, however, in justification of the opinions I have ventured to express, offer one or two instances. I would therefore ask what meaning is to be elicited from the following passage: "We are not to regard the radial space as a mere vacancy, where igneous action is exerted, but as a field where it acts upon matter in states and conditions of which, perhaps, the scientific chemist has but a faint conception; for we are taught, upon the authority of eminent philosophers, that the density of the interior is much greater than that of the crust. It will be perceived by this mode of reasoning, that the force of such a radial space, acting under such conditions, could not but produce results equivalent to the grandeur of its power, and which might justify geologists in referring the origin and actual state of what is called the crust of the earth, to its direct and indirect action." (p. 8 of the report.) I believe that, on the principle of taking "ignotum omne pro magnifico,"* the grandiloquent obscurity of these sentences, which are taken at random, and to which parallels are to be found in almost every page, has not a little contributed to obtain for this report, amongst certain persons, the celebrity which it seems to have acquired. To compensate, however, for the mysticism of the above quotation, in the next page the author favours us with a truism, which cannot fail to be particularly edifying to the European geologists, who, he says, are calling "upon us of this western continent for geological investigations;" for he seems actually to have discovered, that "if, at any period in the history of our planet, the mineral matter constituting the dry land has been distributed beneath the waters of the sea, the planet would then have been entirely covered by water."—(p. 9 of the report.) It was, perhaps, hardly necessary to have gone so far as Arkansas, to ascertain this fact. Mr. F. seems, also, to have discovered a new method of determining heights, to which he, on two or three occasions, refers; for instance, at p 59, he says, "On extricating myself from this arid plain, I reached a ridge with an elevation of about 70°." It is to be hoped that, in his next work, he will favour us with the scale upon which his heights are graduated, for, as he does not refer to any horizontal base, and could not, in the situation which he is describing, command the horizon of the sea, there is at present some ambiguity in his expression.

Some explanation seems to be required, likewise, of his novel mode of estimating the measure of dimensions, for the problem, to find the "superficial cubic contents" (p. 52 of the report) of a body, is one with which we are not familiar.

But I will not dwell on these inaccuracies of language, as it is of more importance to examine the correctness of such of the statements of our geologist, as are more particularly connected with the objects of his tour; for, on the supposition that they may be received as authority, an error in them would be attended with more injurious results.

It may, perhaps, be considered, that he has traveled somewhat out of his record in communicating to us his opinions respecting the gold mines of this country; but as they are delivered with an air of confidence, likely to impose conviction of their truth on persons unacquainted with this subject, they may not be undeserving of remark; for all exaggerated estimates of the value, or probable duration, of these mines, have a tendency to lead to fruitless expenditure, and consequent disappointment.

Mr. Featherstonhaugh states that "Gold mining is yet in its infancy in the United States; in truth, preparations for systematic mining are only now making."—(note to p. 9 of the report.) Persons most conversant with the subject are, however, I believe, unanimous in the opinion, that it has at least reached its full maturity, if, indeed, it be not already past its prime. The only description of gold mines as yet worked with any profit in this country, are those termed deposit mines; and if we look at the present condition of the gold districts in North Carolina and Georgia, where this description of mine has been most extensively found, we shall see that this opinion is not without foundation. In all the counties of North Carolina, south of the mountains, the mines have been worked, and nearly exhausted; in Burke and Rutherford counties, particularly in the latter, where the discovery of mines is of most recent date, there still remain deposites, which, if worked with no greater force than that at present employed upon them, may last four or five years longer; and the portion of the Cherokee territory situated in the state of North Carolina, where it has been ascertained that gold may be found, and in which the mines have been but partially worked, is of very limited extent, and its mines are not considered, by persons who have examined them, to be so rich as those in that part of the territory lying in Georgia. The deposit mines of North Carolina will, therefore, be of finite duration, and the quantity of their produce may be expected to sink gradually under the decline which they have manifested for the last two years.

---

* Tacitus vit. Agric.

The deposit mines in Georgia have, probably, been richer than those in any other part of what is called "the gold country;" but the minute division of property in that portion of the state where they were most abundant, occasioned by the injurious system of lottery, under which it was parceled out amongst the good citizens of the state, and the high degree of excitement into which the public mind had been brought on the subject, occasioned extensive operations to be commenced simultaneously in all parts of the district, as soon as the right of property had been determined.

The extent of each gold lot was small, and the proprietors were eager to reap the golden harvest, by the prospect of which their expectations had been so strongly excited; the consequence of this was, that many of the mines, and some of them the best in the district, were worked out during the first year after the drawing of the lottery; but, so great was the number of adventurers who entered into this business, entirely ignorant of the first principles of mining, that it may be confidently affirmed that more money was lost than made, during that year, in the gold mines of Georgia.

This bad success greatly diminished the number of miners in the succeeding year, but, as those who persevered had acquired more judgment, and conducted their operations with greater skill, their labours were rewarded with better success, and the quantity of gold procured from the mines, during each of the two last years, has been as great as in the first year, and the profits of those engaged in the business more considerable. But this cannot last, and I have been recently informed by an intelligent gentleman, in whose opinion I have full confidence, that nearly all the deposit mines will certainly be exhausted in less than two years more. Some few persons, indeed, who, by their speculations during the drawing of the lottery, obtained possession of several lots, may have reserved localities on which operations may be continued for a longer period, and some of the mines in what are called the older counties, such as that of Mr. Richardson, in Habersham, being of larger extent, may have a proportionably longer duration; the beds of the Chestatee and Etowah rivers may likewise yield gold for a long time, but the annual supply from all these sources cannot be expected to be nearly so great as that which has been afforded during each of the last three years by the mines of this state. I have but little personal knowledge of the mines of Virginia, but by what I have learnt from the accounts of others, the deposit mines of that state have never been either numerous, or very productive. As, therefore, deposit mines are, from the very nature of their formation, and from the ease with which they may be worked, of short duration, in a country where the mining districts are of limited extent, and where the industry of a large population will always be directed to so alluring a pursuit, the hopes of this country for a continued supply of gold from its own resources, must ultimately rest on the vein mines, and it must be to these that Mr. F. alludes, when he says, "preparations for systematic mining are only now making." Now, I am sorry to differ with him in opinion, but I have seen many mines, of various metals, and in different parts of the world, and I never saw one in which more skill and science were evinced in the construction of the works for the reduction of the ore, or in the underground works of the mine, than in the gold vein mine near Charlotte, in Mecklenberg county, N. C., owned by a company in New York, and conducted for nearly three years by the Chevalier Rivafinoli, who was himself a scientific miner, and had under him officers, both natives and foreigners, of competent ability; yet the undertaking entirely failed, not from any want of system, or skill, but because the mine gave out, or became too poor to pay the cost of working. I could mention many other mines, both in North Carolina and Georgia, which at first gave great promise of success, and in which the works, though perhaps inferior to those at Charlotte, were constructed on principles recommended by European practice, but which have all failed from a similar cause. In consequence of these disappointments, vein mining for gold has been very generally abandoned, and I believe no other than the Capp's mine, near Charlotte, was in course of work at the close of 1834. As, during the last year, I have been less acquainted with the actual state of the mines than formerly, I do not know what may be the present prospects of the last mentioned mine, or whether any others have been opened in North Carolina, or Georgia; but the instances I have cited, sufficiently prove that the present low condition of vein mining in those states is rather owing to the poverty of the mines, and to their small extent in depth, than to the want of system, or industry, in their management. Mr. Featherstonhaugh says, "not one shaft has yet been sunk exceeding 160 feet;" a satisfactory reason to account for this is, that every mine, yet opened, has given out before it reached that depth. Several gold vein mines have likewise been discovered in Virginia, and the working of one in Fauquier county has been commenced by a company, which is proceeding with much spirit in the undertaking; it is to be hoped success will crown the efforts of its proprietors, but no reasonable conjecture can be formed as to their prospects, till they have reached the depth of from 100 to 150 feet.

These observations certainly militate against the conclusion, "that the progressive scale of production since 1824 warrants the most favourable anticipations for the future;" for, if they are correct, it may rather be expected that the produce of gold from the mines of this country has already reached its maximum, and is henceforward likely to decrease. According to a statement, which I saw a few days since, of the quantity received in the mint during the present year, 1835, it appears to be less than that received in 1834, by between twenty and thirty thousand pennyweights, and not to amount to more than one-fourth part of the three millions of dollars, predicted by Mr. F. as the produce of the year; and it must likewise be considered, that, in consequence of the advanced price given at the mint, under the new regulation of the value of gold, the proportion of the whole produce which now reaches that establishment, is likely to be greater than formerly.

In page 14 of the report, we find the following remark: "talcose slate" is a mineral formation, in which the auriferous veins of the United States are found, the veins in some parts of the country, passing through a field of talcose slate several miles in breadth, whilst in others they are sheathed only, as it were in the talcose slate, and pass through a field of elvan and granite rocks of various kinds." If by this assertion, it is intended to be implied that talcose slate is exclusively the repository of the gold veins in the United States, it is certainly at variance with general experience; that this formation is favourable to the production of gold, and that veins of that metal are frequently found in it, will readily be admitted, the mines of Virginia and some of those in Georgia are thus situated, but nearly all those of North Carolina and most of those in Georgia are found in a very different rock: and no instance, I believe, of a gold vein in granite has ever presented itself in this or any other country; the small quantity of gold found in Cornwall has always been obtained from the formation, known in that country by the name of killas.

Our author appears to be a believer in the exploded doctrine, that the formation of metallic veins is attributable to the ejection of mineral matter in a state of igneous fusion from the interior of the earth; should the capitalists of Missouri be induced, by a confidence in "the reasonableness of the opinion that metallic veins have their origin from below," (p. 10) to enter with more spirit into the business of mining, it would undoubtedly be a benefit both to themselves and to their country; but should this be their only inducement, it may be feared, that they will be discouraged in the pursuit, when they discover that the most eminent geologists in this and other countries consider that such a mode of their formation is far from being satisfactorily established; if such however is the opinion of Mr. F. he certainly has a right to express it, but as it has been a controverted question, some reasons for such a belief, more conclusive than his arbitrary dictum, would perhaps have been desirable in a work intended to be "permanently instructive."

Mr. F. does indeed refer to some circumstances in a subsequent part of his work, which, he says, "seem to point to a projection of mineral and metallic matter from below:" but, if we examine these circumstances we shall not, I think, find in them, any thing like an argument to support this hypothesis. That the flat or horizontal veins which he met with in the lead mines of Missouri, are "lateral jets from the main lode," cannot be doubted; but the position of the metal at the bottom of the cavities or pockets which he describes, is most satisfactorily accounted for by the supposition that it has percolated, whilst in a state of fusion, through the soft matter of the red clay; for the admission, that it was brought into this situation by a projection from below, would be a contradiction of his own theory of their formation.

From various passages in the report, it is evident, that Mr. F. inclines to the opinion, that bituminous coal is a substance originating from mineral matter; this is another disputed point amongst geologists, and every one is at liberty to defend the side of the question which seems to himself most reasonable. It may however be observed, that the presence of "bituminous matter in beds of fetid limestone" has been satisfactorily accounted for on other grounds, and even admitting as fact the very questionable assertion, (p. 32) that the exclusive carboniferous country, in which coal is found to the west of the Mississippi, does not present a basin-like appearance, in which trees or plants could have been washed, or in which aquatic plants could have adequately grown, still it does not present any argument to disprove the opinion of those who attribute to coal a vegetable origin; for they generally suppose, that the vegetable growth, which produced the coal, was deposited on the spot, where it originally grew, and not that it has been washed into the situations where it is now found; and as the remains of vegetation distinguishable in coal beds, by no means indicate an exclusively aquatic growth, such a disposition might as easily have taken place on a level as on a basin-like surface.

Were I to instance all the glaring violations of philosophical principles and scientific language, which obtrude themselves upon our notice throughout this prefatory essay, I should trespass too largely on the pages of your journal: I must therefore pass them by, and proceed to accompany our geologist on his tour, and as we journey on together, I hope he will allow me the privilege of making such observations, as may enable us duly to appreciate its "interesting results!"

It will be seen that he dashes at once "*in medias res*," and that, although he has presented the public with a map of unusual longitudinal dimensions, he leaves it to be inferred, from his own authority, that its geological delineations are correct, and does not offer any particular explanations of its contents. On his arrival in Missouri, his attention was necessarily directed to the lead mines, which form so prominent a feature in the mineralogical character of that country. These mines appear to lie unusually near the surface, and to be of such exuberant richness, that the main vein extends itself in lateral branches, or, as they are generally termed by miners, flat veins, in all directions, where the softness of the materials of the adjacent country, or natural fissures in the strata of the rocks, permit the formation of the metal. Such of these flat veins as lie nearest the surface, appear to have been broken into fragments, more or less minute, by some great convulsion occasioned probably by that modification of the power of volcanic agency, which so frequently displays itself in the production of earthquakes; a visitation to which the events of the year 1812 have shown this district to be liable; electrical action may likewise, as supposed by Mr. F. have contributed to the production of these effects.

These disruptions of the surface have exposed to view the contents of such of the upper veins, as from their situation were most affected by the shock, and, as a necessary consequence of such exposure of the mineral, adventurers have applied themselves to its extraction, by digging pits on the surface, and have thus brought the face of the country into the disorder described by Mr. F.; and which he attributes to ignorance of the geological structure of the country, and the commonest principles of mining. That such persons were not likely to be great proficients in the science of geology and oryctognosy must be allowed, but perhaps more information on these subjects would not have induced them to alter the mode of their proceedings; for they well knew, that the readiest mode of procuring the ore, was to them the most profitable; and as each individual had nothing more to do, than to dig a pit, and collect the metal it afforded; such a desultory method of working answered the purpose of supplying their immediate wants; and, as they were careless of consequences, they preferred it to entering into combinations with others, and commencing the more laborious and hazardous undertaking of deep mining. The same course has invariably been pursued, on the first discovery of surface mines in all parts of the world, till the right of property was established; in the earliest ages, the mines of Cornwall were thus worked, and, more lately, the gold mines of Georgia suffered from a similar cause, for it is exactly the mode in which the adventurers, or intruders as they were called, conducted their operations, till driven off by the guards of the State. It will be obvious to the intelligence of every scientific miner, that these superficial works, if in the vicinity of a main vein, will be productive of effects exceedingly injurious and embarrassing to any future attempts to work the mine in a more regular manner; and an immediate stop should be put to such proceedings if carried on upon the public lands; for the benefit of the individuals engaged in them, bears no proportion to the deterioration they occasion in the value of the property. The superficial indications of veins, situated as those above described, are necessarily numerous and easy to be understood; for as the gangue of the shattered veins is thrown out with the mineral, when rocks of a similar character are discovered on the surface in other places, it is good evidence of the proximity of a vein, in situations where the mineral may be concealed by the superincumbent soil. I should suppose, it must have been from such circumstances that Mr. F. has been enabled to determine, (p. 51) "that the mineral indications on the public lands were quite as encouraging as at the established mines" for he gives us no particular account of the means he took to ascertain the fact, indeed this brief assertion contains all the information, with which he favours us, respecting the mineralogical character of that portion of the public lands, which may be supposed to contain lead. It is much to be regretted that he did not consider it a part of his official duty to investigate more fully the character of the produce of the lead mines in Missouri, particularly in those places where shafts have been sunk to some depth; for he must have been aware that galena is very generally accompanied by sulphuret of silver, and he might have known, that the substance which forms the gangue of the mines he visited, is similar to that of the gangue of the celebrated mines of Clausthal, in the Hartz mountains in Hanover, which are richer in silver than any other mines in Europe. Such an enquiry would have been interesting both to scientific and practical men, and would have enabled the Government, and the country to form a more correct estimate of the value of the public lands in that state and the neighbouring territories. He does indeed mention in another part of his report (p. 61) "that he had never seen in any portion of the territory of Arkansas, the least indication of the precious metals, apart from a very small portion of silver contained in the sulphuret of lead;" but as he gives no account of any lead mines being worked in Arkansas, he must have formed his opinions on this subject, from the inspection of those fragments of sulphuret of lead, which he describes, as found on the surface, in furrows excavated by the rains; and if he could *see* in such specimens any trace of silver, he surely ought to have considered it as an evidence of much richer argentiferous ore at a greater depth; and to have been induced to examine with more attention the ore from the lowest veins in the shaft at Taplit's and Perry's mine. The next mineralogical object which he notices, and which he describes, (p. 51) as one of the "rarest natural metallic spectacles" he had ever seen, was what he calls a "veinlike mass of submagnetic iron;" this and some other similar beds of iron are upon the public lands, and he gives quite a rapturous description of the benefits to be derived from this discovery; his mode of estimating its value is not however expressed in "terms" quite so intelligible as might be wished. Neither is his description of the iron itself, such as renders it easy of recognition by the mineralogist; for "submagnetic iron" forms neither a species or subspecies in any system of mineralogy, with which we are acquainted: from the circumstance as mentioned in a note, of his suspecting it to contain an "excess of sulphur," it may probably be the magnetic pyrites of Cleaveland, but if so, it is not of much value as an ore. After having sufficiently admired this "extraordinary phenomenon," he proceeded from Missouri into Arkansas, first to Little Rock, and from thence to the Hot Springs of the Washita, and the description of this part of his tour is sufficiently interesting; the most important geological fact, which he mentions in it, is the singular tendency to silification so manifest in that, as well as many other parts of the western country. In the neighbourhood of the Washita Springs, he again met with a bed of iron (he was now provided with a pair of "natural metallic spectacles") which he describes as being magnetic, (a term which we can understand,) and of considerable extent; the situation in which it is found is remarkable, being an elevated cove or basin-like cavity, based upon greenstone, and surrounded by a circular brim of the same rock. His opinion, that the elevation of this greenstone rock is the result of volcanic action is novel, because we have I believe no instance of any of the trap rocks, having ever assumed the conical form, characteristic of modern volcanic mountains, but it may nevertheless be correct.

(TO BE CONTINUED.)

Franklin Institute.

Monthly Conversation Meeting.

The monthly meeting for December was held at the Hall of the Institute, Dec. 24, 1835.

Mr. Franklin Peale explained the construction of a press for milling coins, about to be introduced by him into the U. S. Mint. The simplicity and efficiency of this machine were much admired. It is adapted to motion by steam power.

Mr. Scott, of Philadelphia, exhibited a fireproof chest, of his invention. The imperfect conductor, which encloses on both sides the wooden frame of the chest, is asbestos; this is protected without, by a stout coating of iron. Mr. Scott stated that one of his chests had been in the cellar of a store burned during the late disastrous conflagration in New York, and that the papers and notes within it were found unharmed, when the chest had been dug from the ruins.

Mr. J. Philbrick, of Natchez, Mississippi, illustrated, by a model, a patented invention for protecting cotton, &c., in the act of drying, from sudden showers. The invention will be submitted, for an opinion, to the Committee on Science and the Arts.

Prof. A. D. Bache, from the Committee on the Explosions of Steam Boilers, showed two cylinders, one of iron, the other of copper, which had been burst explosively, by a gradual increase of pressure. He gave an account of the experiments of the Committee on this subject.

Wood cuts, representing these cylinders, by Mr. R. S. Gilbert, were laid before the members, and were much admired.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Messrs. Seymour and Whipple's Fire Alarm.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts to whom was referred for examination, an Alarm in case of Fire, &c., invented by Messrs. Bradford Seymour and Squire Whipple, of Utica, New York, REPORT:—

That the said alarm consists of a coiled spring of two different metals attached to the wall or threshold support, with one end extending out to form an index, moving a few degrees over the arc of a circle, and serving to move a small hammer, which, at ordinary temperatures, is set in a nearly vertical position against a pivot. But on the temperature being elevated to a given extent, which may be limited at pleasure, the index above mentioned, causes the hammer to fall and raise a sort of trigger, which allows a small weight suspended on the inside of an alarm clock, to descend and set in motion the alarm apparatus.

The inventors have mentioned the purpose of this thermometrical alarm to be to give notice of the occurrence of a fire in any apartment in a building, but the committee conceive that it may answer this and many other purposes, in which it may be desirable to be notified of the occurrence of a given elevation or depression of temperature. The apparatus is neat and even ornamental, and as it appears, to the committee, will answer perfectly the purpose intended by the inventors.*

By order of the committee.

November 12*th*, 1835. WILLIAM HAMILTON, *Actuary.*

Report on Philip Laibacker's Door Lock.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, a Door Lock, invented by Philip Laibacker, of Philadelphia, REPORT:

That they have examined the lock of Mr. Laibacker, the improvement in which was stated to consist in a contrivance to cover the key hole; to be used by a person inside, which prevented the introduction of any thing into the lock for the purpose of picking it from the outside.

The lock itself was a specimen of neat and substantial workmanship, of a kind which Mr. L. informed the committee, he had been in the habit of making in Europe; and the application of the safety valve must give it additional security. The manner of effecting this object is by fixing a small sliding plate upon the face of the lock-plate, which, after removing the key, on touching a button at the top of the lock, is shoved by a spring and completely covers the key hole.

The committee believe that the plan before them will fully answer the purpose of guarding and securing the key hole from all pick operations from the outside—but they do not perceive any great advantage it possesses over the common lock with a separate bolt, for supposing a hole to be made through the door to introduce the hand, it would be as easy to remove the cover from the key hole as to draw the bolt.

By order of the committee.

November 12, 1835. WILLIAM HAMILTON, *Actuary.*

Report on Joseph Snyder's Parlour Grate.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, a Parlour Grate, invented by Mr. Joseph Snyder, of Philadelphia, REPORT:—

That this grate is more properly an open stove, constructed chiefly of cast iron, with a lining of fire clay, and is intended to stand upon the hearth within the apartment. The entablature is supported upon two sheet iron columns, through which the heated air passes from the base to the top of the fire-place. To produce a circulation of the gas and hot air (from the coal) throughout the structure, the flue in the head of the stove is divided horizontally into two compartments.

The lower division into which the gas first passes is connected with a flue descending behind the grate; this flue communicates by means of two horizontal passages beneath the grate, with the bases of the sheet iron columns before noticed: these convey the gas into the upper division of the flue at the head of the grate, from which it passes into the chimney. By means of a sliding valve a communication may be opened between the two compartments of the upper flue, so that the gas can pass directly into the chimney without circulating through the fire place. There is another valve beneath the grate, by opening which the air of the apartment is permitted to circulate through the flues and check the draught of the grate.

---

* See vol. xvi., p. 307. [Editor.

The committee are unable to speak of the merits of this grate from experiment, as they have not seen it in operation. But from a simple inspection of it, they are inclined to the opinion that it will render available a much larger proportion of the heat of the fuel than is obtained from a grate set in the usual manner; but perhaps not so much as is afforded by a common coal stove. It is however better adapted to parlour use than a stove by its superior neatness and cheerfulness.

Respecting the novelty of this invention the committee will merely remark, that contrivances somewhat similar to this, for retaining the gas and heated air from the fuel within the apartment, have been in use for many years; and that to sustain a claim on this point, the inventor will be obliged to confine himself strictly to a particular form, and not attempt to claim the broad principle upon which its usefulness depends.*

By order of the committee.

November 12, 1835. WILLIAM HAMILTON, *Actuary.*

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1835.

With Remarks and Exemplifications by the Editor.

1. For a *Lathe for Cooper's Ware;* Isaac Hoover, Miamisburg, Montgomery county, Ohio, July 2.

This, so called, lathe consists of a horizontal platform upon which a barrel or cask, is to be placed and confined by proper dogs, or holdfasts; the platform is made to revolve by turning a winch with a bevil gear, and when the cask is in motion, the tools for champhering, crossing, leveling, &c., properly mounted for the purpose, are held against it. The only claim made is to "the increasing size and power to any extent."

In England and in France the manufacturing of cooper's ware by machinery has been carried to a great extent; but the first establishment of the kind, of which we have seen an account, was in Scotland. Much of the machinery patented here is similar to what has been used for the same purpose there; all the operations which could be performed by giving the vessels, the heads, &c., a rotary motion, have been so performed, and by means the same in substance as that above described.

2. For a *Stove for Cooking and Warming Rooms;* Ernst G. Augustine, city of New York, July 6.

We cannot discover what it is here intended to patent, but as some of our readers may be possessed of a more acute perception than ourselves, we will insert the whole of what is called the description.

---

* See No. 16 of remarks, &c., page 43 in the present volume. [Editor.

"This stove is made of cast iron in a pyramidical form; it consists of a furnace in which is burned wood or coal; an ash pit, over which are openings to receive a boiler on each side of the centre columns. In the centre is an opening in which roasting, frying, and baking, are to be performed; over this oven is an opening to receive another boiler. The steam from all these vessels is conveyed in a tube into the chimney and carried off without any inconvenience.

"The invention here claimed and desired to be secured by letters patent consists in the arrangement and adaptation of the several parts of the stove, by which cooking is performed, and the steam carried off, as before described."

Accompanying the specification is a drawing lithographed, and having between thirty and forty references, but these do not give any light as regards the claims of the patentee.

3. For a *Machine for Cutting Straw;* Ernst G. Augustine, city of New York, July 6.

The claim under this patent is "to the use of a spring fixed below the cutting frame, and attached to it." The remarks upon the preceding specification and drawing apply fully to those now before us.

4. For a mode of *making Shoes, and rendering them impervious to water;* Ernst G. Augustine, City of New York, July 6.

The soles we are told "may be made of plaited flax, hemp, or the inner bark of the linden tree. For the upper part any kind of cloth may be used, and the shoes lined with linen or cotton. The soles are then varnished or covered with the following composition:—one quart of flax-seed oil, two ounces of rosin, half an ounce of white vitriol, which must be boiled together for half an hour. After which take four ounces of spirits of turpentine, and two ounces of white oak saw-dust, which has been exposed twenty-four hours to the sun: mix these ingredients well together, and put them on the soles of the shoes with a brush or in any other way, which when dried will render them impervious to water."

The claim is to "the above described method of making shoes and rendering them water proof." We do not discover any method of "making shoes" contained in the foregoing description.

5. For a *mode of making Vinegar;* Frederick W. Boden, New Lancaster, Fairfield county, Ohio; an alien, who has declared his intention to become a citizen. July 6.

In order to make 32 gallons of vinegar, two gallons of beer, ale, or porter, five and a third of whiskey, three ounces of cream of tartar, twenty-four and two-third gallons of water, are to be put together into a mixing tub, and afterwards into a vessel of convenient size for fermentation. The mixture is to drop through small holes in a division near the top of the fermenting tub, and to fall among chips or shavings of wood placed below it; a tube passes down from the top to the bottom, to supply the necessary quantity of air, and it is said that the mixture will become vinegar in about twenty-four hours. The claim is to the foregoing composition, and to the apparatus employed. It is not long since we read a description of the mode of making vinegar rapidly, as practised in Germany, which is as much like the foregoing as it could well be.

6. For an improvement in the *Art of Combing Wool;* Samuel Couillard, Boston, Massachusetts, July 7.

The following quotation will afford some general idea of the principles upon which the patentee proceeds in effecting his object, which is to separate the fibres of different lengths, and to bring them together when thus separated.

After describing the apparatus used, by written references to a drawing, he says, "upon this principle of drawing wool from the belt it can easily be seen that by placing a number of pairs of draw rollers at different distances from the belt, various lengths of wool can be drawn from it."

"What I claim as my invention is the revolving tooth belt, and the application of a card, or tooth cylinder, or cylinders, to comb wool into teeth passing by its surface, to produce the effect before described."

---

7. For an improved *Root Cutter;* Jonathan Clarke, Hampton, Windham county, Connecticut, July 7.

There is to be a revolving cylinder with knives placed diagonally, or otherwise, across its periphery, and the roots, placed in a hopper, are subjected to their action. The claim is to a machine having such knives, or slitters, a claim which has as little to support it as a large proportion of those made by patentees.

---

8. For a mode of *Applying Horse Power to Machinery;* Thomas Mitchell, Newburg, Orange county, New York, July 7.

An endless floor is to revolve upon cylinders in the usual manner, and under the slats composing it there are to be friction wheels running upon two rails. This apparatus is intended principally to drive thrashing machines.

Where the patentee can have been not to have seen such horse powers, which are extensively diffused over the country, it is not for us to tell, he must have seen but little, or he would not suppose the following claims valid.

"Horse power has been applied in boats on a horizontal wheel. The rotary chain bridge may have been used, but never to my knowledge with a rail-way, rollers, or inclination of the bridge herein described. I claim as my invention the inclined bridge rail-way and rollers, in combination with the other machinery before mentioned, but for which I make no separate claim; and although intended principally for the thrashing machine, I claim also the application of horse power by means thereof to machines for breaking flax and hemp, turning lathes, machinery for propelling boats, and all other machinery to which horse power can be advantageously applied."

---

9. For a *Safety Boiler;* George R. Clarke, Rochester, New York, July 7.

There is to be a cylindrical boiler of the ordinary construction, placed horizontally, and within this a second cylindrical boiler, connected with the former, but so much smaller as to allow of a space between the two, of probably two or three inches; the inner boiler is to contain the water, and should this explode, the outer case is to confine the steam, &c. until it has time to be conducted off by pipes for that purpose. The furnace, which extends along the under part of the boiler in the usual way, must, of course, heat the interior vessel without the intervention of the exterior coat.

This whole plan has so little to recommend it, or rather will stand so self-condemned in the view of all those who are acquainted with the subject as to prevent the necessity of animadversion on our part.

10. For *Cleaning Wool from Burrs, &c.;* M. N. Simpson, Boston, Massachusetts, July 7.

After giving a description of the machine intended to be used, the patentee observes that "wool from South America, and indeed almost all wools, have more or less of a vegetable substance, called burrs, so attached to it that it is not taken out by washing, and therefore the only mode of cleaning the wool has been by hand, until about two years since, a mechanic of the city of Boston, Mr. Lemuel Couillard, jr. invented a machine for the purpose, which performed the part of taking out the burr very well, but was set aside from the injury the staples received. The machine for which I now wish a patent performs the work of taking out the burr without any injury to the fibre. The wool should in the first place be well pinched by a common wool pincher, with the burr in it, and in this state the machine receives it; it is placed by the operation, on the feed belt, which when the machine is in operation is conducted to the draw rolls, which revolve very slow, and as the wool is carried through the draw rolls, the card cylinder takes it in small quantities in a thin state, as it revolves with so much greater rapidity than the feed rolls, and carries it in a continued direction by the clipper frame, which is placed nearly in contact with the surface of the teeth, the burrs and all foreign substances are stopped by the blade of the clipper frame, and the swift revolution of the clipper knocks them off. The wool continues in the teeth of the card cylinder, and is overtaken by the fan which is placed on the opposite side of the clipper frame, and is by the fan blown or taken from the cylinder and deposited in a clean state in the room which may be made for the purpose."

It is stated that the machine may be much varied in form whilst the same effect will be produced, and the patentee says, "I do not therefore claim as my invention any particular form of machinery to effect the object of detaching burrs or other foreign substances from wool, but claim the application of knocking, blowing, brushing, or striking the burrs or other foreign substances from the surface of the card teeth, or any other kind of teeth."

We think this claim may prove too broad, as it will be seen on turning to p. 187, vol. 13, that Mr. Couillard claimed, among other means, the "blowing or striking them off," when properly exposed; it may be, however that in the present machine the removal being effected from "the surface of the card teeth," may so far modify the thing as to prevent the one patent interfering with the other.

---

11. For a *Thrashing Machine;* Joseph Tyler, Brooklyn, Windham county, Connecticut, July 7.

It is no easy task to find the means of making a cylinder thrashing machine in which there shall be anything admitting a legitimate claim to novelty; and it is quite manifest that the present patentee has not accomplished it. He has placed his main shafts to run upon friction rollers, than which few things are more common in machinery; yet he makes this a main foundation of his claim.

"The present claimant does not seek a patent for the cylinder, for the beaters, for the arbors, nor for the concave, because these parts of said machine have been long in use; but he does claim that the pinion wheel, balance wheels, the friction rollers, their size and proportions, and the modes of their application to this machine are entirely new, and are of the original invention of the present claimant. And also this claimant further claims as his invention, the great reduction of power necessary to propel this machine, and the great diminution of friction which has heretofore retarded in a great measure, the operation of machines of this description."

The latter part of the foregoing claim is merely to an effect produced, and it is a well established principle in law that a patent for a mere effect cannot be sustained. Any effect produced must result from certain means employed to produce it, and this latter is the only tangible object for a patent.

---

12. For a *Water Pump;* Amos Miner, Elbridge, Onondaga county, New York, July 7.

The chamber of this pump is to be made of cast-iron, or other metal, and is to be attached to a wooden pump tree that is to lead down into the well. The wood part is to be coated with a cement of rosin and bees-wax, or other similar articles. Particular directions are given respecting the exact measurement of the respective parts, and the mode of connecting them with each other, but there is not in the description any thing that regards construction or arrangement which is worthy of particular notice, or that is in any respect superior to the pumps now in use. The following claims are made.

"1st. The general construction of the pump. 2nd. The application of the pit of the metallic piston to the cylinder of said pump. 3d. The application of the screw for connecting the wooden pipe, or tube. 4th. The manner of constructing the elbows of the pipe. 5th. The application of the resinous composition to the pipe or tube."

---

13. For *Propelling the Stocks of Fulling Mills, &c.;* Elisha S. Norris, Monmouth, Kennebec county, Maine, July 7.

The mode of arranging the levers and joints is different from that usually adopted, but we do not perceive the advantage to be derived from this new plan, or its superiority in the various applications to which, judging from the following claims, it is destined in the mind of the patentee.

"The application of the knuckle joint, or levers, as described, to the fulling mill or washing machine, placing them, as delineated in the drawing, higher up on the stocks. The application of the same to mortising machines, and to the saw mill for sawing timber."

---

14. For a *Door Latch and Lock;* Albert Bingham, Unity, Waldo county, Maine, July 7.

Many variations in spring latches and knobs for doors have been patented within a very few years. The claim made by the present patentee is a very brief one, being merely "the application of the dog to the knob as an inside fastening, as described."

---

15. For an improvement in the *Compensating Tubes for Piano Fortes;* Thomas Loud, city of Philadelphia, July 7. (See Specification.)

---

16. For a *Mortising Machine;* Israel J. Richardson, Palmyra, Wayne county, New York, July 7.

This patent is taken for an improvement upon the machine patented by the above named person, and Joseph Dennis, on the 19th of November, 1833, the improvements being made in the chisel, in the method of securing it and of moving the timber, and in the addition of an apparatus for mortising hubs. For the account of the former patent see vol. 13, p. 263. With the present specification is given an imperfect drawing, in which several of the parts described are entirely omitted, and to which there a e no written references. The improvements in the chisel consist mainly, in making it of cast-iron, with a cutting edge of cast-steel soldered to it. The articles to be mortised are to be forced up by means of a screw; and the hub apparatus consists of a frame in which to hold the hub, and an index plate by which to set it, neither of which are new, and they are therefore in the same predicament with the original machine when patented. The claims made are not to any part of the apparatus, but to the advantages which may result from them.

17. For an improvement in *Mills;* George and Francis R. Baker, Tuscaloosa, Alabama, July 7.

This patent is one great mistake, as the patentees use drums and belts for driving stones, or saws, and say, "we deem ourselves the first who applied bands, or leather belts, to the propelling of water mills for grinding and sawing." They claim "the arrangement of all the parts;" the whole of which are just as new as the drums and leather belts.

18. For an improvement in the *Common Chisel;* George Payne, Keene, Cheshire county, New Hampshire, July 7.

This chisel is to be made with what are called wings, or side edges, for the purpose of pareing within mortises; they are intended principally to be used in mortising machines, but may be employed by hand. The claim is, "only the wings, or side edges," and even this might have been omitted, as such side edges are not new.

19. For a *Substitute for Linseed Oil;* S. T. Todd, and J. L. Peabody, city of Washington, July 7. (See specification.)

20. For an improvement in the *Saw Mill;* Ernst G. Augustin, city of New York, July 17.

The specification of this patent, and likewise those numbered 2, 3, and 4, are accompanied with drawings, lithographed, and furnished with numerous references; it is quite unfortunate that, although there are these aids, a proper attention to which would have rendered the drawing up of a good specification easy, those referred to all fail in every essential point, leaving us entirely in the dark as regards what the patentee considers himself to have invented. In the present case, the claim is to the "before described improvements, with the arrangement and adaptation of the several parts of the saw mill;" yet we are told in the commencement of the specification, that there is no change in the principal parts of the mill.

21. For *Bending or Setting Felloes for the Wheels of Carriages;* Edward Reynolds, Haddonfield, Gloucester county, New Jersey, July 17.

The patentee says, "What I claim as my invention, is the machine, or apparatus, as herein described, and may properly be denominated revolving cylinders, to be used for the bending of felloes for carriages and wagons of all descriptions; sleigh runners; iron tires for wheels; coopers' set hoops, vessels' mast hoops, &c. In which machine two cylinders are employed, operated together by means of certain accessary parts, in the manner, or upon the principle, herein set forth."

We think the machine described well adapted to the bending of timber for rims for wheels. It consists of two wheels in a strong frame, the peripheries of the wheels being nearly in contact with each other; the timber, prepared by boiling, or steaming, is to be bent round one of them, by turning the other, which presses forcibly upon it. An iron band laps round the outside of the bent timber, to prevent its checking; and there are proper staples, and other appendages, for the management of the process.

---

22. For a *Cultivator;* Daniel Davis, Fredericksburgh, Spottsylvania county, Virginia, July 17.

The operating parts of this cultivator are formed very much like the mould-boards of ploughs, and three, or more, of them are to be attached to a cast-iron frame, which takes the place of the wood generally used in such instruments. The handles are to be of wood, and attached by bolts and sockets to the cast-iron frame. Particular admeasurements are given of the individual parts, which, with the cast-iron frame, appear to be relied on to sustain the patent. The claim is to "above described cultivator," which claim appears somewhat too sweeping.

---

23. For machinery for *Rolling up Curtains, Maps, &c.;* Henry Lawson, Boston, Massachusetts, July 17.

The handle by which the curtain, &c., is to be rolled upon its roller, is made much in the form of the old fashioned bell pull, and has a small sheever, or pulley, at its upper end; a cord, one end of which is fastened to and winds round the end of the roller, passes through the pulley, and has its other end fastened to a pin, or other attachment, above; this whole arrangement, it will be seen, is exactly similar to the hanging the weight of a common eight day clock.

"My claim is, 1st, for reducing the length of the draw required to roll up this species of roller blind, shade, curtain, map, &c., to a convenient hand's pull; that is, by one easy move of the hand, to cause the roller to revolve sufficiently to wind up any length of curtain, &c., required for the above purposes.

"2nd. For the pendent balance pulley, and the manner of applying it, as above described.

"3d. For the relative proportions of the barrel and axis, as above described."

All that is said about relative proportions, is, that one part is made *small*, and another *greater*. Rather an indefinite thing to claim.

---

24. For a *Churn;* Oliver Wyman, Dedham, Norfolk county, Massachusetts, July 17.

The body of the churn is, in preference, to be square, as being less expensive than if made round; it has in it a vertical shaft, with dashers; the shaft is turned by means of a winch and bevil gear.

The claim is to "the square churn; the construction of the dasher, and the gearing by which it is turned; and the operation of the several parts of the machinery to effect the purposes above specified."

We have seen several square churns; dashers and gearing like the above may be seen over and over again in the patent office; and the operation of the several parts is, of necessity, like the operation of the like several parts in other similar churns; at all events, the operation is not a thing to claim.

---

25. For a *Cooking Stove;* John Moffat, and Morton Taintor, Buffalo, Erie county, New York, July 17.

This is intended as an improvement on the "self-heat-retaining stove," patented by the above named John Moffat, August 13th, 1834. See vol. xv., p. 190, where the general construction of the stove is so fully set forth, that we need say but little respecting it, excepting to indicate the improvements; these "consist in having the reflectors in the ovens movable, or portable, instead of being fixed. Also, in having a hole near the bottom of the back side of the case, through which air is admitted into the space between the back of the stove, within the case." "Also, the making a steam pipe from the back side of the upper part of the case, to the flue of a chimney, or stove pipe, by which the upper part of the case is ventilated," &c. "And further, that *any kind* of stove which is, or may be, used for cooking or warming purposes, may be enclosed in a heat retaining case, (as described in the aforesaid letters patent, and in this specification,) and used *either for cooking purposes*, *or for heating air* to warm a house, by means of pipes connected with the several rooms."

"We claim the invention of the last mentioned improvements, as therein expressed."

Now, it is to be remembered, that, if the claim to the heat retaining case was good in Aug. 1834, it cannot be made again in July, 1835, or two patents may be held for the same thing. The parts now claimed as improvements are not adequately described, or clearly represented in the drawings.

---

26. For an improvement in the *Manufacture of Potash;* Henry Hartsuff, Tyre, Seneca county, and Cyrus French, Aurelius, Cayuga county, New York, July 17.

The claim is to the "use of dry slacked lime and ashes, in alternate layers, and saturating each layer of ashes with *boiling weak ley*, in which common salt has been dissolved, by which the strength of the ashes is more perfectly obtained in a shorter time, and at less expense."

The directions given are, first, three inches of slacked lime, then five inches of ashes, saturated [moistened] as above; then half an inch of lime, and five inches of ashes, continuing to about five layers of each alternately. Water, or weak ley, is finally to be poured on, until the ashes are exhausted.

---

27. For a *Mortising Machine;* Imla Wright, Centre Antrim, Hillsborough county, New Hampshire, July 17.

"The invention here claimed, and desired to be secured by letters patent, consists in the before described machine for mortising timber, with the arrangement and adaptation of its several parts, particularly in the stock, and adjustment of the stock and chisel."

This stereotyped claim will suffice to vitiate almost any patent for a machine to be applied to purposes to which many others have been previously applied; in the present instance, if there was any thing to claim, it must have been contained within very narrow limits, the general construction of the machine being without novelty.

---

28. For a *Water Wheel;* Isaac Powell, Laurence, Otsego county, New York, July 17.

This is a reacting wheel, with little, if any, novelty about it; at all events, its characteristic features are not pointed out in the specification; and the claim is to "the before described reacting wheel, with the arrangement and adaptation of its several parts."

29. For a *Plough;* patented October 23d, 1829; patent surrendered and reissued upon an amended specification, July 17.

We have said all that we think necessary respecting this plough, at p. 35, vol. v. The present specification, though amended, does not, of course, alter the thing patented.

---

30. For improvements in a machine for *Manufacturing Weavers' Reeds, Headles, or Harness;* Jeptha Avery Wilkinson, Providence, Rhode Island, July 17.

Twenty closely filled pages are occupied by the specification of these improvements on a machine formerly patented by the same gentleman, and twenty-seven figures, with almost countless references in the drawing, forbid any attempt to offer a brief description of a thing consisting of parts "too numerous to be contained in a catalogue."

---

31. For an improvement in *Looms;* Oliver C. Burr, Millbury, Worcester county, Massachusetts, July 17.

It is stated that it has been found very difficult to wind cloth upon the beam of a loom with regularity, as it is woven, and that those plans for doing it which have been successful, are too expensive. By the plan now patented, the beam is to move at each flight of the shuttle, instead of at longer intervals, and, if the thread on the spool breaks, the winding ceases.

By a particular contrivance, the proper explanation of which would require the drawing, the latter is made to communicate motion to the cloth beam, through the intervention of an arm, or lever, the employment of which constitutes the claim.

---

32. For a *Churn;* Reding Ryerson, Jay, Oxford county, Maine, July 17.

The tub of this churn is to be upright, and in the usual form. A shaft passes through the lid, and its lower end is received in a step on the bottom of the churn. The shaft is to be turned by a face wheel and wallower, in the manner of bevil gear, and upon the shaft there are floats, or dashers, some of which are horizontal, and others vertical; the floats are called "cutting floats," and it is to these that the goodness of the churn is attributed, but in what particular they differ from others, so as to obtain their name and value, we are not informed.

---

33. For a *Plough;* Samuel Cline, Plumstead, Bucks county, Pennsylvania, July 17.

The improvement in this plough is said to consist in "placing the line of draught, or beam, so that the resistance to be overcome may bear equally on both sides of that line." The mode of forming the plough so that the beam shall stand in the way mentioned, is particularly described, but this we do not think it necessary to detail.

---

34. For a *Washing Machine;* Asa W. Soule, Portland, Cumberland county, Maine, July 18.

This washing machine has beaters, operating much in the manner of those of a fulling mill, and precisely similar to such as have been before used in washing machines. The arms on which these are suspended, are to be worked backwards and forwards by means of cams, having friction rollers on the ends; the cams and friction rollers constitute the claim.

35. For an improvement in the making of *Artificial Stone Coffins;* John White, Syracuse, Onondaga county, New York, July 18.

It is stated that this patent is obtained for an improvement upon that granted to Daniel Dayton, Hiram Hoyt, and the said John White, on the 6th day of June, for making coffins of American Hydraulic Cement. The improvement claimed consists in the filling in of the coffin, whether originally made of the cement, or of wood, with soft cement when the corpse is put in, for the purpose of excluding the air from the corpse, and also supporting the corpse when the coffin is placed in an erect position." When made of cement, the coffin, it is observed, "may be made of any shape desired; and, if to be placed upright, may be in that of a statue, &c.

---

36. For an improvement in the *Manufacture of Cloth;* Freeman Wolcot, Stow, Middlesex county, Massachusetts, July 21.

This, so called, improvement in the *manufacture of cloth,* is, it appears, an improvement in the napping apparatus, by substituting combs of brass for the teazles usually employed in that process. These combs are made of strips of elastic sheet brass; the teeth in them are to be about an inch in length, a fifteenth of an inch wide at their bases, and tapering regularly to a point. To these plates "a considerable curvature is to be given by swaying; that is by placing the plate thus cut over a concave mould so fashioned as to give the teeth and plate a proper curvature, and then placing a corresponding convex iron over them, and giving it a blow with a hammer. The metallic napper will then be complete, and will be a plate with a row of curved tapering elastic teeth, resembling the teeth of the teazle, and standing out from the uncut part of the plate at such an angle that the uncut part may be attached to slats of wood passing across [along] the face of a cylinder at suitable distances."

"The invention for which, and for the use of which, the said Wolcot claims his patent, is for making from thin brass, a plate, with curved, tapering, and elastic teeth suitable for napping cloth."

---

37. For a *Machine for Shelling Corn,* John P. Small, Gilmarton, Strafford county, New Hampshire, July 21.

This corn shelling machine has a cylinder set with teeth, and a concave against which it operates in the shelling process; it is, in fact, substantially the same with the first corn shelling machine ever invented. The corn falls through an opening at the lower part of the concave, and is cleaned by a revolving fan, in the way frequently practised.

The claim is to "the combination or manner in which the several parts are put together,in the manner above described," which claim might as well have been altogether omitted, as it does not render that new which is actually old.

---

38. For an improvement in the construction of *Stoves for Burning Anthracite, and other Fuel;* Jordan L. Mott, city of New York, July 21. (See Specification.)

---

39. For a machine for *Manufacturing Corks;* Jonathan Cutler, and Isaac Keyes, Putnam, Windham county, Vermont, July 21.

This cork cutting machine has a mandrel which revolves like that of an ordinary lathe. The cutters consist of four or any other convenient number of pieces of steel formed at their ends like an ordinary gouge. They are capable of expanding and contracting, as otherwise, they would cut the cork into a cylinder instead of making it conical. Each of the cutters is hinged, by a handle at its opposite end, to the revolving shaft, and there is a collar so contrived as to cause the cutters to approach each other as the cork is cut. In front of the mandrel there is a horizontal wheel, called a feed wheel, around the periphery of which there are notches to receive the blocks of cork wood, which are ready for the machine. A cam causes this wheel to carry each block, in succession, up to the cutters, into the hollow between which it is finally received, and passes out at a proper opening behind the cutters.

"What we claim as our own invention is the expansive, or cutting cylinder, as connected with the other machinery. Every other part of the machine may be constructed differently, and answer the same purposes."

This machine is skilfully contrived, and described with sufficient clearness; the claim, also, we think well expressed and sufficiently guarded; still, we have doubts of the eventual success of the plan, from the intrinsic difficulties which present themselves in the cutting of cork by machinery. There have been several patented contrivances for the same purposes, but we believe that neither of them has stood the test of continued use. Those who are acquainted with the operation of cutting corks by hand know that a thin and sharp knife is employed for the purpose, and that the edge of this knife is preserved by passing it over a piece of wood between every two or three cuts, the workmen doing this dexterously with one hand whilst the other is employed in taking up a fresh block; without this fine edge the cutting cannot be effected, and we think that in a machine it can scarcely be preserved. Besides this, from the varying thickness of the cork wood, it is no easy matter to have the blocks all of one size. In cutting by hand this is of no consequence, while in cutting by machinery it is all important.

---

40. For an improvement in the *Combined Stove;* for which a patent was obtained on the 13th of December, 1833; Jordan L. Mott, city of New York, July 21. (See Specification.)

---

41. For an improved manufacture of *Knobs or Handles for Stoves or Grates;* Jordan L. Mott, city of New York, July 21.

"My new manufacture consists in the employment of a material for making knobs, or handles, and for the above named purpose; which material is the metal denominated zinc, or spelter. I cast such knobs or handles either in moulds of metal, or in sand, in separate hollow pieces, and unite the same together by means of pins, or screws passing through them in the manner commonly pursued in uniting the parts of brass or other knobs employed for drawers or other purposes."

The claim corresponds with the above statement.

---

42. For a *Churn;* Hiram Phelps, Willeston, Chittenden county, Vermont, July 21.

This churn is to be a square box, standing on legs, and having the bottom concave. Within the box a shaft is to be made to revolve, the floats of which come nearly into contact with the bottom. The particular arrangement of the floats, and the advantages which the patentee thinks will be derived from them we leave to be recorded by some future historian.

43. For the *Application of Asbestos to protect fire proof chests, &c. from the influence of excessive heat;* John Scott, city of Philadelphia, July 21.

"My improvement consists in the application and use of the same material (asbestos) in combination with substances and articles which have heretofore been exposed to the influence of fire without it, but will now derive greatly increased security and protection from its use. These articles are fire proof chests, boxes, closets, doors, and their different parts."

---

44. For an improvement in the *Slide Valves for Steam Engines;* Andrew M. Eastwick, city of Philadelphia, July 21. (See Specification.)

---

45. For a *Rotary Steam Engine;* Mason Young, Buffalo, Erie county, New York, July 21.

This machine is denominated "the spiral spring float propelling Rotary Steam Engine." Like most of its predecessors, it will prove a total failure. We do not mean by this assertion that it will not work, but merely that it will be found very inferior to the reciprocating engine, and that it will not, therefore, be kept going. A wheel is to revolve within a drum, or case, and this wheel is to have buckets, or floats, against which the steam is to act. These floats slide through mortises in the periphery of the wheel, and have shanks furnished with spiral springs to protrude them. They slide in as they pass a stop against which the steam is to react in driving the wheel. Those persons conversant with the miscarriages and abortions which have taken place among those enceint with rotary steam engines will at once perceive that in the foregoing affair there is nothing new in principle, and but little in arrangement.

How widely we differ from the patentee will appear by the subjoined quotation; our difference we apprehend, however, will be but temporary, as actual experiment, will, most probably, convince *one of us*, of his error.

"The advantages the foregoing application of steam possesses, consists in overcoming the *friction*, occasioned by the old method of crank and piston. Also obviating the difficulties arising from the *dead centres*, in the use of the crank and piston plan.

"By the invention or improvement above mentioned it is insisted that nearly all the lever purchase of the wheel is secured. That the expense of construction is greatly diminished, thereby bringing the steam engine into more common use. Lastly: a consideration more weighty than any other, the saving of fuel necessary in generating steam by this new method, by which less steam performs more labour according to the given diameter of the wheel, in nearly an inverse ratio.

"I claim, therefore, the application of the aforesaid method of using steam, as well as the manner of constructing the wheel with its appendages, the cam, or eccentric used in the shell, together with the manner of making the boxes with spiral spring."

---

46. For *Cutting Tenons on Spokes;* William Gerrish, Portsmouth, Rockingham county, New Hampshire, July 21.

This machine is for cutting round tenons by means of a revolving cutter, having in its centre an opening of the size proper to admit the tenon. There are to be three, or any other convenient number of, cutters projecting from the face, which forms the shoulder.

Such cutters have been used for many years for similar purposes, both in braces and in lathes, and there is not any thing in that now presented, essentially varying from, or in any respect superior to, those well known to workmen.

47. For a *Churn;* Russel Bradly, Williston, Chittenden county, Vermont, July 21.

This churn is so much like that No. 42, as to be evidently struck by the same die, notwithstanding the change in the superscription.|

48. For *Stoves;* Daniel West, and Ferdinand Van Sickle, Hudson, Columbia county, New York, July 21.

This stove the patentees call "*the external draught and rarifier,*" and they say that "a more uniform, and a greater degree of heat is produced by the combustion of the same quantity of fuel, than in any other manner." The claim made is to "the rarifaction of the air, obtained from the outside of the room or building, before it is supplied or used for the combustion of the fuel, and the warming or heating the room or building with the surplus of the rarified air beyond what is necessary for the combustion of the fuel; also the grate aforesaid, whatever may be the construction, or however adjusted."

The stove consists of one cylinder within another, the inner one forming the furnace part, and projecting above the exterior case sufficiently high to have a door in it for the supply of fuel, and a opening for the smoke pipe.—Air is to be admitted from the outside of the room into the space between the two cylinders, a portion of which is to pass through an opening to feed the fire, and the remainder through perforations at the top of the exterior cylinder, to heat the room.

The grate is to be a convex segment of a sphere, and is to have a handle with which to tilt it. The whole affair is treated as though it were entirely new, instead of entirely old, with the exception, at most, of allowing a portion of the air from between the two cylinders to feed the fire; and this part is of little importance as it might be as well fed from a portion of that in the room.

49. For a *Double Dasher Churn;* William A. Henrich, Greene, Kennebec county, Maine, July 21.

The churn may be of the common construction, with the exception of there being two dashers, one alongside the other; these are to be worked up and down by means of a crank, or lever, which is the thing claimed, but by how many we have not time to count.

50. For a *Machine for Cleaning Rags;* William Debit, Hartford, Connecticut. First patented January 13th, 1829. Reissued on an amended specification, July 21.

The specification of the original patent will be found at p. 270 vol. iii. The claim in the present specification is in the following words.

"I do not claim as my invention the common duster, or any of its parts; nor the plates, the knives, or beaters, the hollow axles, the shafts, nor, in short, the several parts of the machine, taken by itself. But I do claim as my invention the aforesaid combination of the shaft ,and said knives or beaters with the common duster, improved by said horizontal knives or plates on the ribs, made to revolve so that the knives or beaters on the shaft shall pass rapidly by the ribs and plates of the duster. By these motions and combinations of parts, the rags are agitated, beaten and cleaned."

51. For a mode of *Regulating the height of water in Steam Engine Boilers;* Jesse Fox, Lowell, Massachusetts. Patented April 2nd, 1835; surrendered and re-issued, July 21.

We noticed the former specification at p. 306 of the last volume. The patentee has surrendered this patent, and has put in two new specifications, upon which two new patents have been issued; a procedure sanctioned by former practice, and also by the opinion of the Attorney General.

Without a plate and a very long description, the mechanical arrangement proposed by the patentee, cannot be made known; all we can do is to give a quotation in which the principle of the invention is set forth.

"The principle consists in ascertaining whether water or steam be at any point in a steam engine boiler when in use and operation, by means of a change produced in the action of a piston or plunger moving in a chamber of about four cubic inches, capable of holding in confinement the steam made in such boiler, and having a valve by which the steam or water, as either may be at such point during the operation of the engine, may enter from such boiler into such a chamber, and be confined there for an instant, while the plunger descends therein by means substantially as aforesaid; and the presence of either being ascertained by the change in the action of such plunger in the mode substantially as above described."

52. No. 2 of the foregoing.

To afford some idea of the difference of the modes described in the two specifications, we give the following quotation.

"It is now apparent that the change in the supply is produced by the compressibility of steam, and the non-compressibility of water made effective by machinery; steam opposing no resistance to the descent of the plunger suffers the dog to descend and draws the supply rod away from the boiler, thus increasing the supply as aforesaid; but water resisting the descent of the plunger, and arresting the plunger in its descent for an instant, thereby makes the plunger a temporary prop, and a centre of motion for the lever which is made to work thereon, and lift up the dog, so that the spring shall throw its lower notch upon the catch, and thereby carry the air towards the boiler, and with it the rod, thereby diminishing the supply of water."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for an improvement in the Slide Valves for Steam Engines. Granted to ANDREW M. EASTWICK, *city of Philadelphia, July 21st,* 1835.

To all whom it may concern, be it known, that I, Andrew M. Eastwick, of the city of Philadelphia, in the state of Pennsylvania, have invented an improved slide valve for steam engines, by means of which the action of the engine may be reversed with the utmost facility, thereby rendering this improved valve of special utility in engines for steamboats, locomotives for rail-roads, and for other purposes; and I do hereby declare that the following is a full and exact description thereof.

The slide and steam chest do not differ in their general construction from those in ordinary use, but to the latter an increased length and depth are given, to admit of an additional sliding piece, which I denominate a *Reversing shifting valve seat*, and upon the use of which my improved valve is dependent; the permanent valve seat, also, upon the body of the cylinder, is furnished with openings into steam ways leading into each end thereof, and with an escape opening, which do not differ from those in ordinary use.

The reversing shifting valve seat, above alluded to, has five openings in it, three of which pass directly through it, and are so situated during the ordinary action of the engine, as to coincide with the steam ways, and discharge opening upon the cylinder. The other two openings do not pass directly through the shifting valve seat, but each of them, after descending nearly half way through the seat, is continued laterally, passing along by the ends of two of the direct openings first described, and terminating on the opposite face of the shifting seat; the two lateral communications are at opposite ends of the direct openings. By this arrangement of these two extra openings, the steam which is admitted into one of them, does not pass into the steam way which is directly under it, but into that leading to the opposite end thereof. In consequence of constructing the shifting valve in this manner, all that is necessary to reverse the motion of the engine, is to slide the shifting seat so as to bring the reversing openings into action, and to throw the ordinary openings out of action. For this purpose, a rod connected with the shifting valve seat passes through a stuffing box in the steam chest, so that, by means of a lever, cam, or other contrivance, it may be instantaneously shifted in either direction; the steam chest must, of course, be made of such length as is necessary for this purpose. The openings which are not in action are closed by the divisions between the steam and discharge ways, and by the solid parts of the valve seat.

What I claim as my invention, is the construction of the reversing shifting valve seat, containing the reversing openings, constructed upon the principle, or in the manner, herein set forth, whether the same be made precisely in the form described, or in any other which is substantially the same, producing a similar effect by analogous means.

ANDREW M. EASTWICK.

Specification of a Patent for an improvement in the Construction of Stoves for burning Anthracite, and other Fuel. Granted to JORDAN L. MOTT, *city of New York, July 21st,* 1835.

To all whom it may concern, be it known, that I, Jordan L. Mott, of the city of New York, in the state of New York, have invented an improvement in the construction of stoves for burning anthracite, and other fuel, which improvement is applicable also to retorts for gas works, and to other instruments for the generating or applying of heat. And I do hereby declare that the following is a full and exact description thereof.

For the purpose of description, I will suppose a vertical, cylindrical stove to be constructed, observing, however, that I do not intend thereby to limit myself as respects the form, position, or application, of the apparatus, but only to give an exemplification of a practical mode of carrying the principle of construction into effect.

The body, or furnace part, of this stove, is to be of cast-iron, and consists of any required number of separate rings, of such internal diameter as may be required for the furnace. These rings are to be placed, or superimposed, upon each other to the required height; rims, or ledges, and corresponding grooves, or hollows, being cast upon their touching sides to keep them in their places. Holes are also to be cast in them, or ears formed on them, to receive rods, by which they may be confined together. The lower part of the stove, forming the ash pit, and its appendages, and also that part which is above the fire, may be constructed in any of the usual forms, or of any of the ordinary materials; the improvement made by me consisting entirely in the construction of that part which is formed of rings, or rims, in the way described.

I intend usually to form these rings so that, when put together, the interior of the furnace shall, by their junction, have a uniform, continuous surface, either cylindrical, conical, or otherwise, whilst the outside shall be fluted, ribbed, or grooved, so as to expose a large surface to the action of the external air, as this mode of forming them will, by its extended radiation, tend to prevent their being over-heated.

When used for gas retorts, their outsides will form one continuous surface, as best calculated to receive the action of the fire by which they are to be heated. When used in tubes for the conveyance, distribution, or management, of heat, they must, of course, be so formed as to adapt them to the particular purpose to which they are to be applied.

What I claim as my invention, and desire to secure by letters patent, is the forming the exterior, or shell, of furnaces, or fire-places, for stoves of various kinds, the bodies of gas retorts, and other apparatus which are to be exposed to great alterations of temperature, by the combination of separate rings, rims, or frames, of metal, usually of cast-iron, by which means any difference of expansion in the respective parts may take place without the danger of breaking, whilst any portion which is defective may be easily removed, and its place supplied.

JORDAN L. MOTT.

Specification of a Patent for an improvement in the Combined Stove, for which a Patent was obtained on the 18th of December, 1833. Granted to JORDAN L. MOTT, *city of New York, July 21st,* 1835.

To all whom it may concern, be it known, that I, Jordan L. Mott, of the city of New York, in the state of New York, have invented an improvement in the manner of constructing the stove for which letters patent of the United States were granted unto me on the 30th day of December, 1833; and I do hereby declare that the following is a full and exact description of my said improvement.

The combined stove, so called, and patented by me as above, was intended to unite the advantages of the close stove with those of an open fire-place; and I have heretofore been in the practice of casting the front part thereof in four separate pieces, namely, a front piece, two jambs, and the inclined plane, or curved plate, (described in my former specification,) which conveys the fuel into the grate; but I have found this procedure to be productive of considerable inconvenience, inasmuch as the ordinary defects in casting frequently rendered it difficult to adapt these pieces properly to each other, and more especially from the burning out of the lower edge of the inclined, or curved, plate. To obviate the first of these difficulties, I now cast the entire front, consisting of the inclined, or curved, plate, the horizontal plate above it, forming the front of the close part of the stove, and the two jambs, from a single pattern, in one piece, with the exception of the lower and middle part of the inclined, or curved, plate, which, in order to obviate the second difficulty above alluded to, namely, the burning out of that part thereof which is in contact with the fire, I usually cast in a separate piece. This separate piece I make of sufficient length and width to sustain the whole effect of the fire, so far as the burning out of the curved, or inclined, plate is concerned; the separate piece, so cast, is received in a recess corresponding therewith, in the inclined, or curved. plate, and is retained in its place by suitable ledges, and a screw, or pin, attaching the two parts to each other. To give strength and durability to this separate piece, I form ridges, or reeds, along, or across, the outside thereof, leaving the inside smooth for the ready descent of the fuel. Although I prefer to make a separate plate in the way described, as, in case of its burning out, it is then readily renewed, without disturbing any other part, I sometimes merely form ridges, or reeds, upon the outside of the inclined, or curved, plate, cast in one continuous piece with the parts before named; such ridges, or reeds, occupying the part liable to be burnt out, and considerably increasing its durability.

What I now claim as my improvement on the combined stove, as patented by me at the within mentioned date, is the casting the entire front thereof in one piece, in the manner set forth, with the addition of ridges, or reeds, upon that part of the curved, or inclined, plate which is directly exposed to the fire; I also claim the making, or casting, of that portion of the inclined, or curved, plate which is so exposed, in a separate and distinct piece, in the manner, and for the purpose, herein fully set forth.

JORDAN L. MOTT.

Remark by the Editor.—We have a small stove of the above kind in use as a chamber stove, and have found it to operate extremely well. The coal burnt in it is such as we should formerly have considered as refuse, and which would have been thrown away.

Progress of Theoretical and Practical Mechanics.

Report on the use of the Hot Air Blast in iron Furnaces and Foundries.
By A. GUENYVEAU, *Engineer and Professor in the Royal School of Mines.*

(Translated for this Journal, by Professor A. D. Bache.)

[Continued from p. 66.]

The following details confirm the abstract of results just given.

1*st. Furnaces using coke or coal.*

The results as to economy by using the hot air blast are stated, in the Scottish works, as nearly 3 to 2. At Vienne, the same quantity of coke which was used for 1.075 of ore and flux in the charge, is now used for 1.51. At La Voulte, where the air is heated only to 320° in the manufacture of iron for forging, 1 part of coke is now used to 2.1 parts of ore and flux. At the furnace of Terre-Noire, 1 lb. of coke is used to 1.82 of the mixed ore and flux.

At Torteron, where a mixture of coke (1-3) and charcoal (2-3) is used as fuel, 1 lb. of the fuel is used to 2.83 lbs. of the mixed charge, with the hot air blast. While at the furnace of Guerche, where they use the same ore, flux and fuel, but with the cold air blast, 1 lb. of the fuel is used for 2.98 lbs. of the mixed ore and flux.

At Ancy-le-Franc where charcoal is used, in the proportion of 2-3 oak charcoal and 1-3 of white wood, 2.1 lbs. of the ore and flux require 1 lb. of fuel with hot air, and 2.5 lbs. require the same fuel with heated air. At Wasseralfingen, the increase of the mineral charge when hot air is used is 1.43 to 1, and at Riouperoux, 1.42 to 1.

When iron for forging only is made, and fuel is scarce, it is thought that the hot air blast will be of but little advantage; the company who use the patent for this blast have stipulated for the Creusot furnace, not to pay for the construction of the heating apparatus, in case no real advantage is derived from its use.

In those furnaces which use the hot air blast, and where the mineral part of the charge has been increased, the charges pass less rapidly than formerly, and there are, of course, fewer charges in a given time, but so much more ore passes in the same time that the run of iron is much increased. This increase is greater when the iron is made of the quality for forging than when made for casting. At Vienne, where iron of the second mentioned quality is manufactured, the daily yield has increased in the ratio of 1.22 to 1, while at Janon, where that of the first named quality is used, the ratio is 1.6 to 1. At La Voulte, they produce in twenty-four hours 8 or 9 tons of iron for forging, and it is stated that with an increase of the blast, the yield could be increased to 11 or 12 tons without injuring the quality of the iron.

The greatest advantage from the hot air blast is undoubtedly to be found in the diminution in the enormous quantity of fuel (coal) used in some of the English works. The results obtained in the works of the south of France are the following. At Vienne where they chiefly make iron for casting, they tried the Clyde form of heating apparatus, but abandoned it for that of Calder, by which they heat the air above the melting point of lead. The economy of coke has been in the ratio of 1.37 to 2.50. And the daily yield has increased from 4½ to 5 or 6 tons of iron. The daily product of the two furnaces at Janon, where Taylor's heating apparatus is used, is 8 or 9 tons of iron for forging, by the consumption per ton of 1.20 to 1.40 of coke. This does not include the fuel required to heat the iron. Each of the three furnaces of La Voulte turn out 9 tons of iron for forging, while with the cold blast they made but 7½ to 8 tons of the best quality, under the most favourable circumstances. The consumption of coke is now 1.25 to 1.30 tons for each ton of iron, besides about 600 lbs. per ton, which is required to heat the blast; the former consumption was 2.10 to 2.30 tons of fuel for one of iron. The experiments made in France with crude coal and the hot air blast, have not been conclusive in regard to its advantages, compared with the cold blast.

At the new Torteron furnace where charcoal (2-3) and coke (1-3) are used, the consumption of fuel is about the same for the two kinds of blast. With the hot air blast, however, they make excellent pig iron for castings without any difficulty.

2. *On the use of raw coal in smelting furnaces.*

The substitution of raw coal for coke is doubtless the source of the very great economy observed in the Scotch works, where the heated air blast has been introduced. It was generally believed in this country, as late as 1833, that the hot air blast was indispensable to the use of the fat varieties of coal, without cokeing. It was known that certain dry, bituminous coals, might be used as fuel, even without admixture with coke, and without heating the blast, as is still practised in Wales.

In some of the English furnaces, on account either of the cakeing of the coal, or of its containing a considerable proportion of sulphur, coke is still used with the hot air blast. In one of the Welsh works, they partly coke the coal, and with good effect; a hint which may, perhaps, be improved upon here.

The following observations on the use of coal, of different qualities, with the common blast, have been collected.

A carbonate of iron was advantageously smelted at Vizille,* with a mixture of coke, and of very compact anthracite, with the cold air blast. The high price of the coke rendered the manufacture unprofitable. It has been found at Creusot, that raw coal could be mixed with the coke used, in the proportion of fifty per cent. of the whole fuel, without injury to the quality of the iron, and without diminution in its quantity. At Decazeville, M. Coste found that all the neighbouring coals could be used with the cold air blast, and the furnaces there, as well as at Firmy, have since used no other fuel, except when it was necessary to work up the fine coal. The same weight of raw coal is now used as was formerly of coke. The pig iron has not deteriorated in quality, and the daily yield is the same as before, namely, about five tons.† In all these cases, there is an advantage resulting from the less quantity of earthy matters in the charges, than when coke is used; it has been found at Decazeville, that they require but half the quantity of flux used with coke, when raw coal is substituted for it.

A fact of an opposite kind was presented at Alais, where an attempt to mix raw coal with coke was unsuccessful, the yield of the furnace being sensibly diminished when the coal was but one-sixth of the charge. The coal appears, nevertheless, to be well adapted to this purpose.

At several of the furnaces, such as Terre Noire, &c., coke made from the fine coal is cheaper than the coarse coal, and no advantage can be realized by the use of raw coal.

In regard to the different kinds of coal, it has been observed that those which cake too much, or which fly to pieces, are both ill adapted to use in the smelting furnace. As to other varieties, they may be used either with or without admixture of coke.

The question as to whether the hot air blast is, or is not, necessary, seems to be undecided, observations being contradictory. It is possible that some kinds of coal may render the use of the hot air blast advantageous, or even absolutely require it, while others may work well with cold air. Some may require the hot air blast to drive off the bitumen before they reach the boshes, while others may not need such aid.‡

3. *Smelting furnaces where charcoal is used as a fuel.*

These furnaces requiring a less draught, and being lower than those for coke, are peculiarly well adapted for placing the heating apparatus at the trunnel head. At Wasseralfingen, the pipes are nearly vertical, and pass from the lower part of the furnace to the platform, and back again to the tuyeres; at Ancy-le-Franc they are nearly horizontal, and directly above the trunnel head. An apparatus formed of curved pipes, passing in an arched form over the trunnel head, has been proposed by Mr. Taylor, but appears not to be as durable as that just referred to.

---

* For an account of these important experiments, see this Journal, vol. xv., p. 346.

† In 1835, it is stated that the same furnaces run six tons per twenty-four hours.

‡ It is stated that, at Frederickshutte, in Silesia, a successful attempt has been made to smelt with raw coal as a fuel, and with the cold air blast. The coal does not cake readily. (Erdman's Chem. Journ.)

The experience of several years has proved that the heat of the combustible matters which take fire on issuing from the trunnel head, and of the other gaseous matters, will raise the temperature of the blast to 570° Fah. To this method of heating, several objections have been made; first, that in a well constructed furnace, the air issuing at the trunnel head should not be at as high a temperature as that required for the blast. This objection is not founded on observation, for, besides the heated gases which escape, and which do not burn, there are combustible ones escaping which take fire at the trunnel head, and give out heat by their combustion. It is a well known fact, that, in many works in France and Germany, the heat which would, otherwise, be lost, is applied to various useful purposes. A second objection is, that this mode of heating is dependent upon the proper working of the furnace, and may fail at the very time that heat is required to remove an obstruction in the furnace, from the effect of the very obstruction which is to be removed. This difficulty is easily obviated by burning a few faggots in the flues containing the air pipes, when extra heat is required.

In fact, this apparatus has proved generally satisfactory, requiring neither additional fuel, nor attendance. The exterior of the tubes should be cleaned about every fortnight, to remove dust, and other matters, which would impede the communication of heat. The cleansing of the long horizontal pipes, such as are used at Torteron, is an inconvenient matter.

It may be well to repeat, here, the results obtained by the hot air blast at Wasseralfingen. At a cost only of the construction and repairs of the heating apparatus, the daily yield of the furnace was increased thirty-nine per cent.; the quality of the iron, for casting, was not deteriorated; and the consumption of fuel was diminished from 1 to .61. The temperature of the air was from 390° to 400° Fah.

At Ancy-le-Franc, the consumption of charcoal per ton of iron was diminished twenty per cent., while the iron was improved for castings. The air was heated to 570°. The want of power of the blowing machine prevented a due supply of heated air, and the daily yield of the furnace was decreased.

I have been informed that there are several works in Franche-Comté, where they heat the air blast from the trunnel head. They have a greater daily yield, and consume less fuel than formerly, but state that the working of the furnace is not so regular as before. This, probably, depends upon some defect in their construction, since it certainly is not a usual accompaniment of the hot air blast.

At Hayange, (Moselle,) a furnace twenty-six feet in height, and using charcoal, was supplied with the hot air blast. By means of an apparatus like that used at Wasseralfingen, the air was raised to 612° Fahr., and even above this point. The area of the blast pipe was doubled, and the pressure slightly diminished. The charge of ore was increased from 430 lbs. for 22½ cubic feet of charcoal, to 680 lbs. The same number of charges were made per day, and the gain resulted only from the increase of ore in each charge. The heating apparatus has required no repairs since its establishment, a year ago. In another furnace, at the same place, the heating apparatus having given way, the cold air blast was resumed at an additional expense of twelve per cent. of charcoal, per ton of iron.

It is stated in a German journal,* that, by heating the air from a hydraulic blowing machine, by an apparatus at the trunnel head of a furnace, a saving of twenty-five per cent. of fuel had resulted. The air was heated to 480° Fah.

At Plons, in Switzerland, they have used the hot air blast to advantage, the fuel being a mixture of wood and charcoal. Each charge consists of 81 lbs. of charcoal, nearly half being from hard, and the rest from resinous wood, and 198 lbs. of pine wood, which would have yielded 48 lbs. of light charcoal; of 220 lbs. of ore, containing 51 per cent. of iron, and 60 lbs. of an argillaceous flux. From 18 charges they obtain, in twelve hours, 20,196 lbs. of pig iron. The economy is reckoned at about 33 per cent.

These results are more satisfactory than those furnished by charcoal, alone, and cold air, or even than those afforded by charcoal and the hot air blast. So successful are they considered, that a saw mill has been established to cut the wood to the required size.

[TO BE CONTINUED.]

Hunter's Patent Stone-Planing Machine.

In March last, a patent was granted to Mr. James Hunter, of Leys Mill, Arbroath, "for certain improvements in the art of cutting, or what is commonly called facing and dressing certain kinds of stone." The specification of Mr. Hunter's method has not yet been enrolled; but from a Report, with a copy of which we have been favoured, made to the proprietor of the Leys Mill Quarries (W. F. L. Carnegie, Esq.) by Messrs. Carmichael and Kerr, engineers, of Dundee, who were invited to see the method in actual operation at these quarries, and to verify the results, it appears to be immensely superior to any other hitherto devised. Mr. Hunter has seemingly realised that great desideratum, a power-machine for the cutting and dressing of stone, capable of withstanding the extraordinary friction to which it must be necessarily subjected. The dispatch with which immense blocks of stone are cut up and dressed, by Mr. Hunter's apparatus, is prodigious; yet the cost of tools is next to nothing—"only a half penny-worth of steel for every hundred feet of planed surface?"

Report of Mr. Charles Carmichael, and Mr. John Kerr, Engineers, Dundee, on the power of Mr. James Hunter's Stone-planing Machine.

Sir,—Agreeably to your desire, we have visited Leys Mill Quarries, and attended minutely to the performance of the stone-planing machines. These machines do their work most effectually, as the following experiments, which we witnessed, will testify.

Experiment First.

We went to one of the machines that had six stones laid on the bench, one of which was planed, and the second begun to be operated upon; while this was doing we took the dimensions of the other four stones, viz.:—

Number of Stones.	Length of Stones.		Breadth of Stones.		Thickness.	Finished Thickness.	Quantity taken off.
	Feet.	*Inches.*	*Feet.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1	5	3	2	6	3½	2½	1
2	5	0	2	8	3	3⅜	⅝
3	5	6	2	6	6	4¼	1¾
4	4	0	2	3	4	2½	1½

---

* Erdman's Journal, vol. xviii., p. 340, 1833.

The average thickness of the above stones are given, but many parts of them were much more than the thickness stated. One of the broad finishing tools was blunted ere the experiment began, and was changed when No. 2 was in the operation of being planed. No. 3 was a very hard stone, and was what is technically called yolk, in planing which one of the roughing tools broke at the point; still it wrought out the stone, and was then replaced. A splinter came off the face of the last stone, when about half-finished, which was another cause of delay, as they had to go over it again; but, notwithstanding the delay occasioned by the breaking of one tool, by another being changed, and by having to go over the one-half of the last stone twice, yet the time altogether was forty-five minutes, being at the rate of sixty-five superficial feet per hour.

Experiment Second, (same machine.)

Five stones were now put on the planing machine, of the following dimensions, viz.:—

Number of Stones.	Length of Stones.		Breadth of Stones.		Thickness.	Finished Thickness.	Quantity taken off.
	Feet.	*Inches.*	*Feet.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1	4	3	2	2	4¼	2¼	2
2	3	9	1	10	4¾	3¼	1½
3	3	4	2	8	6	4	2
4	3	6	2	0	6½	4¾	1¾
5	3	8	3	6	5½	4½	1

These stones were planed in forty-two minutes.

The above stones were taken from the quarries without selection, and the men that were working the machine were not informed of the object of our visit. Experiment First, began at half-past twelve o'clock, noon, and Experiment Second, was concluded at nine minutes past two; thus leaving twelve minutes for cleaning and reloading the bench of the machine. Had all the stones been 5½ feet long, they would have been planed in exactly the same time, for the machine travels the distance for that length; so that nearly sixty-seven feet of surface would have been planed in forty-two minutes.

The stones, as they come from the machine, are remarkably smooth and straight on the face; and were it not for the shade left by the tools, we would be apt to think them polished, as they feel as smooth as a polished stone.

We were told by the foreman that, during the last week, there was planed 4,400 superficial feet, more than half of which was planed on both sides (indeed more than half of all the stones that leave the quarry are planed on both sides), by four machines. We saw the payment list for the week;

	£	s.	d.
the amount was - - - - - -	£6	1	6
Add blacksmith for dressing and grinding tools - -	0	12	0
	£6	13	6

We were further informed by the manager that, during the last summer, there were upwards of 100,000 feet of pavement planed by four machines; and there was one thing that struck us most forcibly, which is the small degree of wear on the tools. Three shillings a week, or six pence per day, is the cost of the labour for dressing and grinding the tools of one machine; and the whole consumption of steel during the last year was under one hundred weight, so that, if we measure both sides of those stones that were actually planed on the two sides, it will be seen that a pound of steel will plane 1,500 feet, or about a halfpenny-worth of steel for every 100 feet of planed surfaces.

There are now five machines working in the quarry, wrought by a steam engine of six-horse power, the steam cylinder of which is 16 inches diameter, stroke 2 feet. Besides the machines, the engine has to work two inclined planes, one of which is for dragging up the pavement from the quarry to the machines; the distance on the incline 48 feet, ascent 1 foot in 5; average quantity about thirty tons per day of ten hours.

The second incline is for dragging up the rubbish from the quarry to the place where it is deposited; distance 87 feet, ascent 1 foot in 4; quantity from 50 to 60 tons per day of ten hours.

The above shows what the engine is actually doing; and we have no hesitation in saying that the engine could work eight machines besides the inclines, without being overloaded; and our opinion is that a machine, on the average, is not much more than one-half horse power.

Note by Mr. Carnegie.

To explain the difference which is apparent between the quantity of planed stone, which, according to the statement of the engineers, *might* be produced in a given time by the machines, and the quantity stated to them as in one week actually sent to market, it is necessary to remark,—1st, That it is found in practice to be cheaper to dress the stones by the machine in the rough state and shapeless form in which they are taken from the quarry, and to square them by hand afterwards, than to follow the opposite course, as is done when the whole work has to be performed by hand; thus a great quantity of work measured by the engineers, but not available in the market, is nearly lost. 3d. A considerable quantity is required to be dressed over twice on one side, or on both sides, according to circumstances; thus the stones, No. 3, in Exp, 1, and Nos. 2, 3, 4, 5, in Exp. 2, being too thick, were redressed on the under side to suit the market. 2d. The quarry does not always afford stones of a size to fill the benches, when much power is lost, as the machine has to traverse the whole width. 4th. Other circumstances (such as bad weather, &c. &c.) which will readily present themselves to the minds of those conversant in these matters, always occur to prevent general results from attaining the extreme limit, which may be calculated as possible, from the data of a short experiment. Mr. L. C. having been present, can confidently testify as to the correctness and impartiality with which these experiments were conducted, and to the truth of the information furnished to the engineers by those in his employment.

Lond. Mech. Mag.

A TABLE

Showing the number of Houses supplied by the Water Companies of London, &c.

According to the Returns made to Parliament, in 1834.

Name of Company.	Number of Houses supplied	Gross annual Income.			Average annual Expenses.*			Height of supply abo. Thames.	Aver'ge dail sup. to each House.	Average ch'ge. for water per House.†			Amount of capital employed.			Average value of each share.			Profit per cent. on the capital.		
		£	s.	d.	£	s.	d.	Feet.	Galls.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
New River	73,212	104,909	0	0	38,000	0	0	145	241	1	6	6	1,116,964	0	0	15,512	0	0	4	0	0
Chelsea	13,891	22,906	0	0	13,481	0	0	135	168	1	13	3	271,311	0	0	56	10	6	1	15	0
West Middlesex	16,000	45,500	0	0	18,000	0	0	155	185	2	16	10	404,263	0	0	68	8	9	3	0	0
Grand Junction	11,140	26,154	0	0	11,000	0	0	151¾	350	2	8	6	334,174	0	0	60	4	3	2	10	0
East London	46,421	45,234	0	0	15,889	0	0	107	120	1	2	9	594,988	0	0	118	19	11	3	15	0
South London	12,046	8,839	0	0	4,000	0	0	80	100		15	0	245,306	0	0	98	0	0	2	0	0
Lambeth	16,682	14,808	0	0	6,500	0	0	185	124		17	0	182,553	0	0	144	17	8	2	2	6
Southwark	7,100	7,850	0	0	No return.			60	156	1	1	3	95,000	0	0	One person's property.			No return.		

* In this statement of annual expenses, there is no allowance to provide a fund for repairs, improvements, casualties, &c., which amount to a considerable sum.

† The average rate includes public buildings, breweries, distilleries, &c.; but the rate charged to many houses is only ten or twelve shillings; and all the water for extinguishing fires is gratuitously supplied—the conflagration of a single house commonly requiring from 700 to 1000 hogsheads.

The number of houses supplied in 1820, was 120,732; in 1827, 176,205; in 1833, 199,493; which shows an increase of 78,761 during thirteen years, although considerably more than 10,000 houses have been taken down to effect various improvements, &c., and none erected on the same sites.

Progress of Physical Science.

On some elementary laws of Electricity, by W. Snow Harris, Esq. F. R S.

(CONTINUED FROM p. 70.)

7. The inductive effect of a quantity of electricity distributed upon a conductor is directly as the quantity and inversely as the distance between the electrified body and that in which induction is produced.

Induction is not modified by atmospheric pressure being the same in the air and in a partially exhausted receiver.

8. The attraction of an electrified disk for a neutral uninsulated one, varies inversely as the square of the distance between their planes, supposed to be parallel.

(*a*) This force is not at all influenced by the force or disposition of the unopposed portions of two conductors, being the same in disks as when they are backed by hemispheres, cones, &c. Two hemispheres therefore attract each other with the same force as two spheres of the same radii.

(*b*) The attracting force is as the number of attracting points directly, and their distances inversely.

(*c*) The attraction between two unequal circular areas is equal to that between two areas each equal to the lesser.

(*d*) The attraction between a circular ring and a circle is the same as between two rings.

(*e*) The attraction between a sphere and a spherical segment of the same curvature, is the same as between two spherical segments equal to the one used.

A point may be determined in each of two hemispheres where the whole attractive force may be supposed to reside. The distance of this point from the intersection of the line of nearest approach of the spheres with the spherical surface is $z = \frac{(a^2 + 2\ ar)^{\frac{1}{2}} - a}{2}$, where a is the least distance between the spheres and r the radius of each. The attractive force will vary as $\frac{1}{a\ (a + 2\ r)}$.

9. "It is demonstrated, that the resistance of the air to the passage of electricity is as the square of the density directly, so that a given quantity, having a given intensity, and about to discharge [from] or flow upon a given point, will remain in the same relative state in air of half the density, if the distance between the points of discharge be doubled; or generally if as the density of the air be decreased the distance between the points of action be increased, the electrical accumulation will still remain complete. If therefore, the density of the air be indefinitely diminished, and the distance between the points of action indefinitely increased, we shall have eventually the same relative electrical state continued, without dissipation; so that if we imagine the opposed body to become nothing, then the accumulated electricity will not tend to leave the electrified body at all, supposing it to be without the influence of all other substances. Discharges of electricity under a diminished atmospheric pressure do not seem to occur so much in consequence of a tendency of the electric principle to evaporate, as it were, in all directions into space, but rather in consequence of the removal of the non-

conducting particles interspersed between the points, *from* and *towards* which, the accumulated electricity tends to flow. It is hence extremely doubtful, whether a general distribution of electricity in mere space would ever occur, supposing the electrified substance to be the only existing body in the universe: directly, however, that we assume the existence of another body, there is a space devoid of resistance, the resulting induction would generate an attractive force, which, however small, would cause an electrical current to flow through a distance, however great."

This most singular deduction is supported by the following direct experiments. A sphere of brass was placed in the centre of a glass globe and supported there by a brass stem which was connected with a delicate electroscope. No collapse of the leaves of the electroscope had occurred when $\frac{59}{60}$ths. of the air had been withdrawn from the globe.

Under an adequate attractive force electricity passes more readily over the surface of bodies in a rarified medium.

10. The recession of electrified bodies from each other does not depend upon the action of the air in which they are placed, the repulsion of two gold leaves placed in a larger receiver being maintained undiminished when $\frac{299}{300}$ths. of the air was withdrawn.

"Electrical divergence is, unquestionably, an extremely intricate phenomenon. If it be assumed to depend on a repulsive force immediately impressed upon the molecules of certain kinds of matter, then it must be admitted to be a species of repulsive action essentially different from any repulsive agency in nature of which we have the least experience. Its operation is at great distances, and is exerted between distinct and concentrated accumulations of the repulsive matter disposed on the surfaces of bodies; and whilst thus exerted at sensible distances, it is either altogether controlled by some other force, or otherwise so feeble as to be incapable of producing an electric diffusion by expansion, under an extremely diminished atmospheric pressure."

Experiments to measure the velocity of Electricity, and the duration of Electric Light. By CHARLES WHEATSTONE, ESQ., *Professor of Experimental Philosophy in King's College, London.*

The continuance for a certain time of all luminous impressions on the retina prevents our accurately perceiving, by direct observation, the duration of the light which occasions these impressions; but by giving the luminous body a rapid motion, which produces the appearance of a continued train of light along the path it has described, its condition at each moment may be ascertained, and consequently its duration determined. The same law of our sensations precludes us from direct perception of the velocity with which the luminous cause is moving, as the whole of its track, for a certain distance, appears to be equally illuminated; but by combining a rapid transverse motion of the body from which the light proceeds, with that which it had before, its path may be lengthened to any assignable extent, and both its duration and its velocity will admit of measurement. The author gives various illustrations of this principle, and of his attempts to apply it to appreciate the duration and the velocity of the electric spark. His first experiments were made by revolving rapidly the electric apparatus giving electric sparks; but in every instance they appeared to be perfectly instantaneous.

He next resorted to the more convenient plan of viewing the image of the spark reflected from a plane mirror, which, by means of a train of wheels, was kept in rapid rotation on a horizontal axis. The number of revolutions performed by the mirror was ascertained by means of the sound of a siren connected with it, and still more successfully by that of an arm striking against a card, to be 800 in a second. The angular motion of the image being twice as great as that of the mirror, it was easy to compute the interval of time occupied by the light during its appearance in two successive points of its apparent path, when thus viewed; and it was ascertained that the image passed over half a degree (an angle which being equal to about an inch, seen at a distance of ten feet, is easily detected by the eye) in the 1,152,000th. part of a second. The result of these experiments, as regarded the duration of the spark, was that it did not occupy even this minute portion of time; but when the electric discharge of a battery was made to pass through a copper wire of half a mile in length, interrupted both in the middle, and also at its two extremities, so as to present three sparks they each gave a spectrum considerably elongated, and indicated a duration of the spark of the 24,000th part of a second. The sparks at both extremities of the circuit were perfectly simultaneous, both in their period of commencement and termination; but that which took place in the middle of the circuit, though of equal duration with the former, occurred later, by at least the millionth part of a second, indicating a velocity of transmission from the former point to the latter, of nearly 288,000 miles in a second; a velocity which exceeds that of light itself.—*Proceedings of the Royal Society, June* 14, *quoted in Arcana of Science*, 1835.

On the Repulsive Power of Heat. By the Rev. Baden Powell, *Savilian Prof. Geom. Oxford.*

Prof. Powell examines an experiment of Signor Libri, from which the repulsive power of heat was inferred, namely that when a drop of water was placed near the end of a wire placed horizontally, or even inclined a little upwards, on heating the wire the drop receded from the heated part. A repetition of this experiment produced only a slight motion explicable by the increased vaporization on the side next to the heated part of the wire. A drop of oil placed in a capillary tube, when part of the tube is heated, recedes from the place of heat, because the tube is rendered slightly conical. No effect was produced on liquids contained in capillary tubes though heated until they boiled, nor on a drop between two inclined plates which were heated, nor on a globule of mercury suspended from a glass plate, by heating the plate.

Mr. Fresnel placed disks of foil and mica before a delicately suspended magnetic needle, and brought them against fixed disks, when the needle was a little inclined to the meridian so as to press the disks together. On applying the heat of a lens to the disks they separated. The experiment was made in a highly rarified medium. Professor Powell repeated the experiment, remarking that the effects might be produced by the greater heat of the surface exposed to the sun's rays, which would render it convex. By pressing the disks closely together, the coloured rings formed would give a test of the interval between the disks. The tints invariably descended in the scale when heat was applied, showing that the intervals between the disks increased. By using two lenses the exact amount of the interval may be calculated. The effect of expansion will be, when a convex lens is placed upon a plane, or convex, or even upon a concave surface of less curvature than the lens, to diminish the angle between the lens and surface, and so to cause the rings to enlarge. But on the contrary they regularly contract and the central tint descends in the scale until the whole vanishes, by an increase of interval. This it would seem must be due to a real repulsive power developed by heat.

From experiments made by the contact of a lens with different substances, Prof. Powell infers that whatever tends to increase the rapidity of communication of heat, tends to increase the observed effect. The effect is increased when water instead of air is introduced between two lenses.

Abstract fr. Royal Soc. Trans.

The Aurora Borealis as a Prognostic of the Weather.

The view intended to be enforced in the following extracts is that a display of the Aurora is immediately succeeded by high winds and storms.

1. *Notice of instances of the appearing of the Aurora Borealis, seen from Dundee, Perthshire, in* 1833 *and* 1834, *and the state of the weather subsequent to the several instances. By* Wm. Gardiner, Jr. Esq.

"These northern illuminations have been very frequent of late as the subjoined list of dates of their occurrence in 1833 and 1834 will show. From circumstances, I have been unable to make scientific observations on these interesting phenomena, but the statements I communicate are facts, and facts however simple and apparently of little value in themselves, often come to be useful. The object I have in view, you will perceive, is to establish that the Aurora may be relied upon as a sure prognostic of the weather. From the observations which I now bring forward, as well as a multitude of similar ones made prior to 1833, I have learned that an Aurora is *always* succeeded by moisture, and frequently by storms, that are in general, proportionate to the brightness, extent and length of duration, of the luminous manifestation."—[*Loudon's Mag. of Nat. Hist. No*. 46.

2. *Remarks Contributive to the Elucidation of Meteoric Atmospheric Phenomena. By* W. H. White, Esq.

I have been thus particular in a detailed account of the weather during the latter part of December 1830, because I have generally found variable and stormy weather to succeed Auroras, particularly if they were accompanied with many meteoric appearances. During the period of my observations of atmospheric and meteoric showers, I have invariably found that a gale of wind, generally from the S. or S. W. has followed an aurora within thirty hours, or at most thirty six hours; but differing in degree according to the splendour and magnitude of the aurora, and meteoric appearances; and therefore I think the following observations will hold good. The more splendid and active an aurora is, the more violent, and, consequently, in the shorter period, is the gale that succeeds, and the shorter its duration; and on the contrary, the more languid and dull the aurora appears, the longer the gale is in approaching, the less its violence, and also the longer its continuance. I should feel obliged by the observations of other gentlemen on this interesting subject, because, if the fact be universally true, particularly in high latitudes, of what importance would it be to our navigators, especially in the Northern Ocean, to pay particular attention to those interesting phe-

nomena, as they might be enabled to prepare against the storm which that appearance may be said to predict.—[*Loudon's Mag. Nat. Hist. No.* 46.
Old Kent Road, Dec: 10th, 1834.

3. *Aurora Borealis, of Oct.* 12, 1833.—Mr. Fielding who describes a splendid display of the Aurora, seen at Hull, England, on the evening of Oct. 12, 1833, states that it was followed by a sudden fall of temperature in the air. The wind on the next day was from the east, inclining to the south, and in the evening blew in gusts from the south west. There were showers of rain on the evening of the 13th.—[*Loudon's Mag. Nat. Hist. No.* 37.

Dark Colour of the Sky at Considerable Heights in the Atmosphere.

Dr. Barry read a paper on the dark colour assumed by the sky in the higher regions of the atmosphere, and instanced his own observations on ascending Mont Blanc. At a particular elevation, when surrounded by fields of snow, the sky deepened in tinge, and became dark violet; this he endeavoured to prove to be the effect of certain rays emanating from the snow, and received upon the retina of the eye. In order to shut out this influence, he stretched himself on his back, and giving the eye a short rest, the dark colour disappeared, and various shades, more or less, developed as he shut out or admitted those rays, to his vision. These various shades, and the corresponding influences which gave rise to them, he very ingeniously reduced to a scale, and illustrated them by comparison with the various tints afforded in the decomposition of light by the agency of the prism, [*Proceedings of Brit. Assoc.—Rep. Pat. Inv.*

Civil Engineering.

Observations on the Motions of Shingle Beaches. By Henry R. Palmer, *Civil Engineer.*

The object of Mr. Palmer is exclusively practical, and his observations intended to furnish rules for controlling the motions of a beach, so far as to preserve a clear channel through it at all seasons, and in every variety of weather.

1. The motions to be explained. That the pebbles which compose the shingle beaches on these coasts, [Kent and Sussex, Eng.] are kept in continued motion by the action of the sea, and that their ultimate progress is in an easterly direction, are facts long known, and commonly observed. The following observations are chiefly directed to the particular manner in which the motions are produced.

From a general view of the effects which I have noticed, it appears that the action of the sea upon the loose pebbles is of three kinds; the first heaps up, or accumulates, the pebbles against the shore; the second disturbs, or breaks down, the accumulation previously made; the third removes, or carries forward, the pebbles in a horizontal direction.

For convenience, I propose to distinguish these by the following terms, viz: the first, the accumulative action; the second, the destructive action; the third, the progressive action.

All the consequences resulting from these various actions are exclusively referable to two causes; the one to the currents, or the motion of the general body of the water in the ebbing and flowing of the tides; the other to the waves, or that undulating motion given to the water by the action of the winds upon it; and it is of considerable importance to the present inquiry, that the effects resulting from each specific cause be separately considered.

The motion of the shingles along the shore is commonly attributed to the currents, the action of the waves being considered only as a disturbing force.

That the current is not the force which moves the pebbles along the coast, will appear from the following reasons.

1st. If it were so, the direction of the motion of the pebbles would be determined by the currents; but while the direction of the currents will vary with the change of the tides, we find that the direction of the pebbles may remain unaltered; and also, that the motion of the pebbles is continued when no current exists.

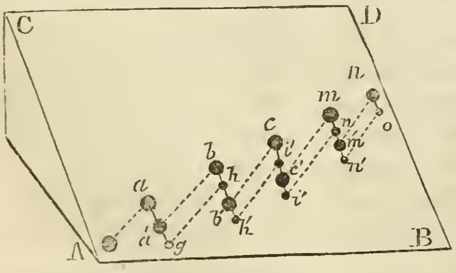
2d. Although the velocities of the currents may not have been ascertained with precision, yet it is known that the velocities, generally, along this coast, which can possibly act on the shingles, are not sufficient to give motion to pebbles of every dimension, which are, in fact, carried forward.

3d. That the motion of a current will not produce that order in which the pebbles are found to lie, which order, as will hereafter be shown, may easily be distinguished as the effect of the motion of the waves only.

The direction of the waves is determined principally by the wind, the prevailing direction of which, on the coasts referred to, is from the westward. Every breaker is seen to drive before it the loose materials which it meets; these are thrown up the inclined plane on which they rest, and in a direction corresponding, generally, with that of the breaker. In all cases, we observe that the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstices; but we perceive that the larger pebbles return only a part of the distance, and, upon further inspection, we find that the distance to which each pebble returns, bears some relation to its dimensions. This process is an indication of the accumulative action.

But, under some circumstances, depending upon the wind, it is found that pebbles of every dimension return with the breakers that forced them up the plane, and that these are accompanied also by others, which have been previously deposited, but which are, in such cases, disturbed by the waves; and by a continued repetition of the breakers acting in this manner, the whole of the shingle previously accumulated is immersed below the surface of the water. This process is an indication of the destructive action.

The particulars of the accumulative action, *combined with that of progression*, are explained as follows.



Let A B C D be an inclined plane, representing that on which the loose pebbles move. Suppose the wind to blow in such a direction as to cause a wave to strike a pebble at A, in the direction of A, *a*, and to the distance (*a*) up the plane, that point being the extent to which the force can reach. Now here the wave breaks partly into spray, and is dispersed in all directions, is partly absorbed, and descends in a shallow form, which rapidly diminishes in its depth, so that the pebble is soon left exposed, and, therefore, does not return the whole distance with the water, but is left at rest at *a′*, being at a higher level than that from which its motion commenced.

With the rise of the tide, the striking force is also elevated; and by the repetition of the operation described through the different heights in succession, the further motion of the pebble will be represented by *a b c m*, &c., the distance in each step of its descent being something less than in that of its ascent, until it has reached the summit (*n*) determined by the height of the tide. Now, if we suppose a pebble of less dimension than the former to be struck from the same point, we shall find it raised as before; but, because its surface is greater in proportion to its weight, and because, from its less bulk, it remains longer immersed in the declining wave, it will descend further, and follow the line *a g*, &c., and will not be left at rest till it has reached *o*.

So much effect has been attributed to the motion of the tidal currents, that vast sums have been expended in attempts to divert the motion of the shingles to a distance from the shore, from whence, by the increased depth and velocity of the current, it has been expected they would be carried past a particular spot, through which a permanent open channel has been required. Such attempts have been made at various periods, during upwards of two centuries, at Dover, and more recently at Folkstone, in the same neighbourhood. It is hardly necessary to observe, that they have not been successful, and, from the principles which I have laid down, their failure may easily be accounted for.

If a wall, or pier, be extended from the shore into the sea, it is evident that such erection will, in the first instance, impede and prevent the progressive motion; that motion is again restored, and the general mass proceeds as if no impediment had existed.

The most perspicuous evidence of these results is exemplified at the harbour of Folkstone.

Previously to the commencement of this exclusively artificial work, the beach traveled along the line of the cliff in the ordinary way.

By extending the walls a sufficient distance into the sea, it was expected that a commodious harbour would be formed, and the shingles diverted so far into deep water, that they could not again appear above the surface until they were removed beyond the harbour's mouth.

The accumulation, however, immediately commenced, and continued as the work advanced, until it became apparent that no other effect was produced upon it than a comparatively slight change of direction; the entrance of the harbour being much encumbered with shingle, an additional pier, or jetty, was erected, and extended about two hundred feet further into the sea, without having approached the effect intended. It is true, that some advantage was derived from the extended pier, by increasing the distance between the most violent action of the breakers, and the still water of the harbour. The shingles, therefore, pass the mouth in a more dispersed form than they originally did, and hence they do not as readily form a barrier, neither does its perpendicular height become so great.

If, then, it be admitted that projecting piers will not prevent the encumbrance about the mouth of a harbour, situated, as those referred to, in the tract of the restless beach, it remains to be seen how far such works may be otherwise injurious.

While the accumulative action is going on, every abrupt projection from the coast is an impediment to the progressive motion of the beach, till its angle is filled up. Such abrupt projections offer no protection against the destructive action; when, therefore, by the increase of the wind, the action of the sea becomes violent, an accumulation previously caused by a projecting pier is rapidly removed, and again is rapidly deposited where it is not resisted. And there is, perhaps, no combination of circumstances less capable of resisting, or more favourable to the deposition of, the shingle, than is found in artificial harbours, shielded by an *abrupt* weather pier on a line of beach.

With a long continuance of violent winds from the same quarter, every accumulation of loose shingle is broken down, and is hurried forward, whilst it unremittingly appears to seek protection. During the recent gales, every inlet within the tract of the beach was seriously encumbered with it, commenced with the heap accumulated by the very pier that was intended to prevent such an effect, (where such existed,) and increased by the successive arrivals of those more remote, together with that quantity commonly passing along the sloping plane, but now brought down by the destructive action, and forced along with accelerated motion.—[*Abst. Phil. Trans.* 1834.

Liverpool and Manchester New Canal.

We understand that it is intended to form a canal between Liverpool and Manchester, parallel with the famous rail-way, and nearly of the same length viz: thirty-two miles.

The new canal is intended for the cheaper conveyance of the passengers, luggage, light goods, and parcels which are now carried by the Liverpool railway coaches and wagons. This undertaking owes its origin to the unprecedented success, in point of despatch and cheapness, of the light passenger boats on the Scotch canals between Paisley, Glasgow, and Edinburg, and to the invention of a new apparatus for passing light boats rapidly up and down the ascents and descents of canals without loss of time or expenditure of water.

This apparatus is now in the process of being established on the Forth and Clyde canal. It is simple in its form and cheap in its construction, and from the length of the boats, being unrestricted by locks, a great additional buoyancy to the boats and consequent increase of their velocity is obtained.

With respect to the cheapness and speed of this conveyance, the experience of several years has now fully proved that passengers and light goods are easily and regularly conveyed on canals in light iron boats drawn by two horses, and accommodating from 100 to 150 passengers; at a speed of 10 miles an hour and upwards, and at fares less than one third of the Liverpool railway fares, and from thirty to forty per cent. less than the actual cost of outlaid expense of conveyance on the Liverpool railway, and it has also been ascertained that the speed on canals can, if necessary, be increased to twelve miles an hour.

The cost of making the new canal perfectly complete, is estimated at 250,000*l.* or nearly 8,000*l.* a mile. It will require no locks, and only a small reservoir to supply the evaporation of water in summer. It will have a towing path on each side; that is, one for the horses in each direction. The time consumed in the journey between Manchester and Liverpool, (including that of the omnibus conveyance at each end) will not exceed three hours; the great obstacle to speed arising from locks, and restricted length of the boats to suit the locks, being now removed.

The fares to passengers in the new canal, will not exceed the rates charged to passengers on the Paisley Canal, the average of which hardly exceeds one half penny per mile. The average fare on the new Liverpool and Manchester Canal will therefore be about one half penny per mile: or from seventeen pence to twenty pence for thirty-two miles, the distance between Liverpool and Manchester.

This average rate of fares is less than one-third of the average rate of fares exacted from passengers on the Liverpool railway, and from thirty to forty per cent. under what the Liverpool Railroad directors have, in their printed reports, stated to be their outlay on each passenger conveyed by them between Liverpool and Manchester. At this low rate of fares the proprietors of Scots canals, and particularly the Paisley Canal, have during the last four years, been increasing the number of their passage boats, and the frequency of their voyages or trips. On the Paisley canal the boats start from Paisley to Glasgow twelve times a day—that is hourly, and as often from Glasgow to Paisley.

There being little trade between Edinburgh and Glasgow, the trips of the boats on the canals between the two cities, are not so frequent as on the canal between Glasgow and Paisley. But the number of miles run by the passage boats on the canals between Edinburgh, Glasgow and Paisley daily, are upwards of nine hundred miles; whilst the total number of miles run daily by the passenger coaches and uncovered wagons on the Liverpool and Manchester railway, amounts only to 550 miles daily.

Another striking fact is certain. The gross amount of the fares levied daily for running these 900 miles on the canals, does not much exceed one-half of the sum stated by the railway directors as the actual cost of running 550 miles on the Liverpool railway. And yet a large proportion of the canal receipts are profits to the canal companies, who have been thereby induced to go on regularly in improving their passage boats, and increasing the number of their voyages.

On the canal between Liverpool and Manchester, it is proposed that a boat shall start from Manchester to Liverpool, and another boat from Liverpool to Manchester, at the end of every hour, for twelve hours daily, thus giving twelve opportunities from Liverpool to Manchester, and as many from Manchester to Liverpool, and running 768 miles daily, or 280,325 miles in the course of the year.

The boats are to be constructed and fitted up in the same manner as those on the Paisley canal, with two neat cabins, which will easily accommodate from one hundred and twenty to one hundred and fifty passengers, or three thousand six hundred passengers daily.

The cost of running these boats, stated at the same rates as on the Paisley canal, will be £11,000 yearly, including interest of the capital or cost of the boats and of the horses employed in drawing them, and a sinking fund to compensate their deterioration, and provide for their replacement.

The above calculations are based upon the actual cost of running exactly similar boats and some larger boats on the Scots canals. From the great extent of the trade, wealth and population of Manchester and Liverpool, compared with Paisley and Glasgow, the quantity of passengers and goods conveyed on the canals between Paisley and Edinburg, must be altogether trifling compared to that which will be conveyed by the canal between Manchester and Liverpool; and judging from what has already been effected by the increased speed and unparalleled cheapness of the improved iron boats on the Scots canals, it is calculated that the light iron boats on the new canal between Manchester and Liverpool will be amply supplied with goods and parcels, and that the revenue arising from the trade will be at least 20 per cent. on the capital expended.

A very large revenue, also, may be assuredly expected from night boats, carrying light goods, parcels, luggage and passengers, at lower rates than during the day, as has for several years been done on the Forth and Clyde, and Union Canals between Edinburgh and Glasgow. In these night boats the charge for a parcel not exceeding one stone in weight will be only 4d. which is just one third of the Liverpool Railway charge.

When it is considered that the average fares to passengers on the famous Liverpool Railway are from triple to quadruple the average fares in the neat and comfortable cabins of canal passage boats, running ten miles an hour, and that many of the railway passengers are conveyed in uncovered wagons, the success of the proposed undertaking may be considered as perfectly secure. For even supposing the railway company (encouraged by their corporate privilege exempting the partners from being liable for the debts of the corporation) were to reduce the fare of their passengers to the mere outlay or cost of the conveyance, it will be from thirty to forty per cent. above the canal fares, which after defraying all expenses, afford a handsome profit or dividend to the canal proprietors.

Unlike the railway, the new canal will furnish accommodation to all the country on its route, equal to that given by the railway to the towns only at each extremity; for passengers on the canal can be received or landed by the boats whenever required.

The whole line of the canal may thus, from frequency and ease of access, become like a main street connecting Liverpool and Manchester, and furnish sites for all kinds of manufacturing and chemical establishments, the canal affording a constant and abundant supply of water.

As soon as the new canal is fairly established and the quiet, smoothness, speed and unrivalled cheapness of the conveyance are experienced, we may expect to have opportunities not merely every hour, but every half hour, of passing between Manchester and Liverpool, at one third of the expense by the railway.—*London Public Ledger.*

Mechanics' Register.

Authorship of an improved method of setting rails.—A suggestion to the following effect will be found in Prof. Barlow's report, page 127, vol. xvi. of this Journal. "I suggest as a matter deserving the attention of practical men, that as the bar must necessarily contract, it will draw from that end which is least firmly fixed, and hence all the shortening will probably be exhibited at one end however slight the hold on either may be; and when it happens that the adjacent ends of two bars both yield, the space is double. To avoid this evil, one of the two middle chairs in each bar might be permanently attached to the rail, in which case the contraction must necessarily be made from each end."

In a very rough article in the August number of the London Mechanics' Magazine the credit of the suggestion is claimed by Mr. James Woodside, one of those competitors whose plans Prof. Barlow examined. In the mildest tone of rebuke, the Professor replies, admitting that the suggestion is certainly due to Mr. Woodside, although he had not recollected having so derived it when his report was written, and adding that while Mr. W. was certainly right as to *fact* he was certainly wrong as to *motive.*

We could wish that similar admission, as to facts, had been made by the re-inventors of Hare's Compound blow-pipe and of the jet attached thereto. The second inventors were Mr. Rutter and Prof. Daniell of England.* B.

Hancock's Steam Carriage.—A correspondent of the London Mechanic's Magazine states that the journey from London to Hounslow, the distance being 75 miles has been performed, going and returning at the rate of about 9¾ miles per hour. The stoppages swelled the time of each jaunt to nearly twelve hours.

Maudesley and Field's Steam Carriage.—From the same source it appears that the jaunt above referred to has been made by a steam carriage of Maudesley and Field. The rate about ten miles per hour. The time out 8h. 10m. and back in 11h. 22m. including stoppages.

Experiments for the safety of the Steam Engine.—Under the act of the 30th of June, 1834, "authorizing the Secretary of the Navy to make experiments for the safety of the steam engine," and appropriating five thousand dollars for that purpose, many proposed improvements have been submitted for the purpose of being tested by experiments. Some of these were so easily tested by those having steam engines in operation, that the aid of Government was not needed: others were attended with greater difficulty, and could not be tested without the expense of constructing boilers and other machinery for the purpose. These proposed improvements have not been such, as in my opinion, to warrant a large expenditure of money; and no experiments have been made upon them. Such experiments, however, would have been made, if they could have been made without the expense of constructing engines.

"The act seemed particularly to require that the steam engine devised by Benjamin Phillips, of Philadelphia, should be examined and tested; and that Mr. Phillips should be employed in making the experiments. Mr. Phillips was therefore employed to construct a model engine, with boilers and other machinery which he deemed necessary for the purpose of testing his improvements, which he brought to this District, where he remained several weeks making his experiments before many members of both Houses of Congress, before the officers of the different Departments, and others.

"I attended very carefully to these experiments; but have not been able to perceive in them any improvements, increasing the safety of the steam engine."—[*Rep. of Sec. of Navy to Congress*, 1835]

New African Expedition of Discovery.—This project is to begin the exploration to the south, and to travel northward, by caravan. The district to be explored is that between the termination of Denham and Clapperton's discoveries to the north and Campbell's and others to the south. It comprehends about 30° of latitude. Attempts were making in London to procure subscriptions for the outfit and maintainance of the expedition.

Undulating Railway.—Arguments on this subject are still presented both pro and con. A one sided view of it has been taken in this journal, but one which has not been satisfactorily refuted: see the report of R. Stephenson, Jr., vol. xv., p. 1. and an article in vol. xii., 1833.

Mechanical Knighthood.—Mr. Stephenson has been appointed a knight of the order of Leopold.

Cooking by Gas.—It is stated in the London Mechanics' Magazine, that with no more complex contrivance than a sheet iron cylinder covered with wire gauze, and placed over a gas light, two quarts of water in a common copper tea-kettle may be boiled by the consumption of three cubic feet of gas. The gas issuing from the jet pipe mixes with the air in the cylinder, and the mixture is set fire to above the wire gauze.

---

* See this Journal, vol. xi., p. 149.

Howard's Quicksilver Engine.—A trial of this engine, which uses the vapour of mercury as a moving power, is to be made at Lisbon in the steam packet Comet.

Current through the Straits of Gibraltar.—A writer in the Nautical Magazine for September, explains thus the current which sets constantly from the Atlantic to the Mediteranean through the straits of Gibraltar. The specific gravity of the water of the Mediterranean has been ascertained to be 1030 while that of the Atlantic is but 1028. The depth between Ceuta and Europa point is 4200 feet. A column of water of the specific gravity of 1030, and of the height of 4200 ft. would balance one of the specific gravity of 1028 and of the height of 4208½. The difference of level of the two seas if a barrier were placed across the surface, and equilibrium produced by pressure on the water below, would be 8½ feet. The waters of the Atlantic tend to press in therefore at the surface, while the denser water of the Mediteranean flows out at the bottom. Observations in proof of such an under current have been made.

List of Patents which issued in November, 1835.

	November
682. *Prussiates, making and dying with.*—Felix Fossard, City of Philadelphia,	7
683. *Cutting Straw,* &c.—Henry C. Jones, Rochester, Ohio,	7
684. *Charcoal Kiln.*—E. B. Gilbert, Euphrata, New York,	7
685. *Horse Rake.*—James Pudney, Stanford, New York,	7
686. *Crackers, cutting.*—L. P. Clarke, Baltimore, Maryland,	7
687. *Cutting Straw.*—Ashman Hall, Putnam County, New York,	7
688. *Grist Mill.*—Philip Hauser, New Haven, Connecticut,	7
689. *Rotary Steam Engine.*—John G. Hotchkiss, New Haven, Connecticut,	7
690. *Smut Machine.*—John Tuck, Columbus, Pennsylvania,	7
691. *Canal Steam-boat.*—John Elgar, Baltimore, Maryland,	7
692. *Rail road and Canal Transportation.*—John Elgar, Baltimore, Maryland,	7
693. *Balance for Counters.*—Elias A. Hibberd, Lunemberg, Vermont,	7
694. *Tanning, extract of Bark for.*—Otis Batchelder, Bedford, New Hampshire,	7
695. *Horse Collars.*—H. C. Call, Sterling, Connecticut,	14
696. *Screen for Grain.*—E. P. Fitzpatrick, Mount Morris, New York,	14
697. *Anti-friction box.*—E. Fisk, and J. C. Green, Fayette, Maine,	14
698. *Steam engine, centrifugal.*—Charles J. Conway, city of New York,	14
699. *Cisterns, &c., water proof.*—Levi Kidder, city of New York,	14
700. *Anodyne sirop.*—Rezin Thompson, Rome, Tennessee,	14
701. *Floating dry dock.*—Rufus Porter, Bellerica, Massachusetts,	14
702. *Smut machine.*—E. P. Fitzpatrick, Mount Morris, New York,	14
703. *Japan for leather.*—William Gates, Hanover, New York,	14
704. *Fireplace, &c.*—J. Douglass, S. Durham, Maine,	14
705. *Truss for hernia.*—V. Wilkinson, city of New York,	14
706. *Hair, extracting from skins.*—Nahum Swett, Readfield, Maine,	14
707. *Truss for hernia.*—Robert Semple, Vandalia, Louisiana,	14
708. *Propelling by screw.*—E. P. Fitzpatrick, Mount Morris, New York,	23
709. *Cheese press.*—W. C. Greenleaf, Andover, Maine,	23
710. *Spark catcher.*—G. Holbrook, Boston, Massachusetts,	23
711. *Feathers, dressing.*—B. Smith, Schodack, New York,	23
712. *Medicine administered by steam.*—Ben. Grut, city of New York,	23
713. *Sopha, &c., springs for.*—E. Cherrington, Boston, Mass.	23
714. *Bedstead and mattress.*—E. Charrington, Boston, Mass.	23
715. *Rail-roads.*—E. Johnson, Rochester, New York,	23
716 *Horse shoe machine.*—Henry Burden, Troy, New York,	23

List of American Patents for December, 1835.

717.	*Spring saddle.*—Adam Hickman, Abingdon, Virginia,	23
718.	*Floating dry dock.*—J. R. Campbell, and J. S. Withington, Boston, Mass.,	26
719.	*Steam boilers.*—Thomas Ashcroft, Boston, Mass.	26
720.	*Chilling castings.*—Henry Saunders, Greensburg, New York,	26
721.	*Mortising machine.*—J. M‘Bride, Richmond, Indiana,	26
722.	*Turnabouts for rail-roads.*—David Evans, Philadelphia county,	26
723.	*Canal boat, sheet-iron.*—L. Parmellee, Poughkeepsie, New York,	26
724.	*Spring saddle.*—Charles Bates, Staunton, Virginia,	26
725.	*Water wheel.*—Edward Newman, Stilesville, Indiana,	26
726.	*Asbestos, application of.*—John Scott, Philadelphia,	26
727.	*Sheet-iron fireplace.*—Gilbert Richards, Ashfield, Mass.	26
728.	*Cotton seed huller.*—John Ambler, Jr., Philadelphia,	26
729.	*Hydrant.*—Sater T. Walker, Baltimore, Maryland,	26
730.	*Grist mill.*—Samuel Hyde, Malone, New York,	26
731.	*Saw.*—John Ruthven, city of New York,	26
732.	*Spark catcher.*—J. W. Waples, Wilmington, Delaware,	26
733.	*Cloth winding machine.*—J. Goulding, and J. Brackett, Boston, Mass.	26
734.	*Diving dress.*—J. R. Campbell, Boston, Massachusetts,	26
735.	*Kiln for grain.*—Thomas Crook, New Hope, Pennsylvania,	26
736.	*Hot air hearth.*—L. V. Badger, and R. Walker, Portsmouth, N. H.	26
737.	*Cutting straw.*—John Wirt, Evansham, Va.	26

List of Patents which issued in December, 1835.

		December
735.	*Cupola Furnace.*—L. V. Badger, Portsmouth, New Hampshire.	2
736.	*Pencil and crayon points.*—George C. Baldwin, Ticonderoga, N. Y.	2
737.	*Smoothing metals.*—Bradford Seymour, Utica N. Y.	2
738.	*Rail road car wheels.*—Arundius Tiers, Kensington, Penna.	2
739.	*Sunken vessels, raising.*—W. Atkinson and E. Hale, City of New York,	2
740.	*Water-proof boots.*—David Clarkson, City of New York,	2
741.	*Brakes for cars,* &c.—John K. Smith, Port Clinton, Pa.	2
742.	*Drilling rock*—Aaron Van Cleve, Stonington, Conn.	2
743.	*Iron pipes, casting.*—John D. Morris, Kensington, Pa.	2
744.	*Cooking stove.*—Henry Stanley, Rutland County, Vermont,	2
745.	*Weaving stock frames.*—F. Goodell and T. W. Harvey, Ramapo, N. Y.	2
746.	*Clover seed, hulling.*—George W. Taylor, Bridgetown, N. J.	4
747.	*Cooking stove.*—Bennington Gill, City of N. Y.	9
748.	*Cutting straw,* &c.—Leonard Marsh, Windsor County, Vt.	9
749.	*Hats, traveling.*—V. De Brain, City of N. Y.	9
750.	*Truss for prolapsus,* &c.—John F. Gray, City of N. Y.	15
751.	*Fire place.*—Charles Lane, Hingham, Mass.	15
752.	*Pressing brick.*—Ulysses Ward, Washington City,	15
753.	*Flour bolt.*—Aritus A. Wilder, Mount Morris, N. Y.	15
754.	*Laths, cutting.*—Barnabas Langdon, Troy, N. Y.	15
755.	*Tobacco press.*—John W. Weems, West River, Md.	15
756.	*Buckwheat, cleaning.*—Daniel T. Laning, Cumberland County, N. J.	15
757.	*Sharpening razors, &c.*—William Child, Baltimore, Md.	15
758.	*Water cistern.*—Alfred Palmer, Syracuse, N. Y.	16
759.	*Lamp.*—Cyrus Rust, City of N. Y.	28
760.	*Door locks.*—J. K. & H. C. Campbell, Charleston, Mass.	28
761.	*Steam gauge.*—Samuel Raub, Jr. Wilkesbarre, Pa.	28
762.	*Thrashing grain.*—Moses Davenport, Phillips, Somerset County, Md.	28
763.	*Cleaning feathers.*—Edmund Wood, Owego, Tioga County, N. Y.	28
764.	*Brick machine.*—Benjamin Hamblet, Portland, Me.	28
765.	*Amalgamating mill.*—J. Curtis, N. Y.	28
766.	*Amalgamating mill.*—J. Curtis, N. Y.	28
767.	*Amalgamating mill.*—J. Curtis, N. Y.	28
768.	*Cam press,* &c.—Alonzo S. Grenville, Cambridgeport, Mass.	30
769.	*Ironing, &c. clothes.*—Samuel Swett, Jr. Readfield, Me.	30
770.	*Thrashing machine.*—Amos Hanson, Windham, Me.	30
771.	*Mowing machine.*—A. M. Wilson, Rhinebeck, N. Y.	30
772.	*Clock escapement.*—James Fulton, Shelby County, Ky.	30

CELESTIAL PHENOMENA, FOR MARCH, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
1	7	36	Im. *η* Leonis,	,3,4,	N. 73°	V. 25°
1	8	52	Em.		238°	191°
4	12	16	N. App. ☽ and γ′ Virginis, ,4,	☽ North 2.′3		
8	16	26	N. App. ☽ and ζ Ophinchi, ,5,	☽ South 2.′5		

Meteorological Observations for November, 1835.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.	Direction.	Force.		
				Inches	Inches			Inches.	
	1	37°	46°	30.45	30.30	E.	Moderate.		Clear day.
	2	38	54	.25	.15	NE.	do.		Lightly cloudy—cloudy.
	3	39	60	.00	.30	W.	do.		Cloudy—lightly cloudy.
	4	50	66	.00	.06	S.	do.		Fog—hazy.
🌝	5	54	61	.00	29.95	SW.	do.		Dense fog—cloudy.
	6	53	52	29.95	.96	SE.	do.		Cloudy—do.
	7	49	57	.85	.85	SE.	do.	.16	Rain—cloudy.
	8	47	59	30.00	30.00	SSE.	do.		Drizzle—cloudy.
	9	53	59	29.80	29.80	SE.	do.	.65	Rain—clear.
	10	42	51	.83	30 00	NW.	do.		Clear—rain in the night.
	11	52	51	.50	29.10	S.	Blustering.	1.02	Rain—flying clouds.
	12	38	44	.12	.10	W.	Moderate.		Cloudy—flying clouds.
☾	13	34	36	.50	.80	W.	do.		Cloudy—clear.
	14	26	45	30.00	30.00	NW.	do.		Clear—lightly cloudy.
	15	42	55	.00	29.98	SE. W.	Calm.	.10	Cloudy—lightly cloudy—rain.
	16	55	61	29.80	.75	SW.	Brisk.		Cloudy—do.
	17	46	48	.80	.80	NW.	Moderate.	.10	Cloudy—Aurora Borealis.
	18	44	50	.84	.85	SW.	do.	.10	Cloudy—rain.
	19	46	52	.85	.85	SW.	Calm.		Cloudy—foggy.
⊗	20	50	65	.83	.65	SW.	Moderate.		Mist- partially cloudy.
	21	49	53	.80	.85	W.	do.		Cloudy—lightly cloudy.
	22	37	36	30.20	.20	N.	do.		Snow—drizzle.
	23	32	33	.00	.75	NE.	do.	1.15	Sleet—rain,
	24	35	35	29.80	.95	N.	do.		Cloudy day,
	25	28	37	30 05	30.12	NW.	do.		Clear—lightly cloudy.
	26	24	37	.05	.05	W.	do.		Lightly cloudy.
	27	28	35	.09	.06	NE. SW.	do.	.05	Cloudy--snow.
☽	28	32	38	29.75	29.75	W.	do.		Lightly cloudy.
	29	19	24	.70	.75	W.	do.		Clear day.
	30	20	35	.85	.76	W.	Brisk.		Cloudy day.
	Mean	39.96	44.50	29.88	29.85			3.33	

	Thermometer.	Barometer.
Maximum height during the month,	66. on 4th.	30.45 on 1st.
Minimum do.	19. on 29th.	29.10 on 11th & 12th.
Mean do.	44.23	29.86

Note to Readers.—In order that the Selections might not be crowded out of the present number, an extra form of twelve pages has been added. The paging is the same as that of the preceding form, with "bis" added.

The report of the Committee on Explosions will be continued in the next number, and concluded in the following one. COM. PUB.

Erratum.—In the list of patents for 1835, the final number, 772, is correct. The last three numbers for November, and the first three for December, are the same, owing to certain patents having been erroneously marked as issued in the Patent Office.

JOURNAL
OF THE
FRANKLIN INSTITUTE
Of the State of Pennsylvania,
AND
MECHANICS REGISTER;
DEVOTED TO
Mechanical & Physical Science,
CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

(*Continued from page* 92.)

The temperature of maximum vaporization was obviously about 292° Fah. The effect of the polish was thus distinctly shown by a comparison with the preceding table, which gave 327½° to 329½° for the same point. Perfect repulsion took place as low as 315° Fah. In repeating this series, with the surface tarnished by the effect of the heat and water used, the temperature of maximum vaporization was raised to 325½°, and of perfect repulsion to about 378°, confirming the conclusions from the preceding series.

3. The same copper bowl in a bath of oil, the surface being clean but not smooth; and again, the surface being very much oxidated, but free from grease, gave the results recorded in the next table. The nature of the bath would not, probably, materially affect the results with so small a quantity of water; the cooling effects, of the vaporization of the drop, upon the surface of the metal being inconsiderable. In these rough surfaces the effect of giving a tendency to motion to the drop of water, by allowing it to fall on the sides of the bowl, becomes very appreciable. This tendency assists the force of repulsion, and frequently determines a considerable increase in the time of vaporization.

The first series in the annexed table, consists of results obtained when the dish was clean but the surface not smooth; the second and third, when the dish was free from grease, but much oxidated.

Fah.°	Surface clean.				Surface oxidized.				Surface oxidized.			
	Descending Series.				Descending Series.				Ascending Series.			
	Side drops.		Centre drops.		Side drops.		Centre drops.		Side drops.		Centre drops.	
	Time in sec's.	Remarks.	Time in sec's.	Remarks.	Time in sec's.	Remarks.	Time in sec's.	Remarks.	Time in sec's.	Remarks.	Time in sec's.	
283.5	1	. .	1½	.							.	
290.6	.	. .	> 1		.							
292.6	.	. .	1	Nearly.								
294.7	.	. .	¾									
296.7	.	. .	.	. .	.	. .	.	. .	.	. .	3	
298.8	.	. .	¾	. .	.	. .	> ½					
300.9	.	. .	<1	Very small drops are *still repelled.*								
302.9												
305.0	.	. .	.	. .	.	. .	½	About.				
307.1	.	. .	1	Small drops rep'd.	.	. .	.	. .	.	. .	2½	
309.2	.	. .	.	. .	.	. .	> ½					
311.2	.	. .	1½	. .	.	. .	.	. .	.	. .	2	
313.2	.	. .	2	. .	.	Still repelled.						
315.3	.	. .	.	. .	.	. .	½&¼	. .	.	. .	1½	
317.3	.	. .	.	Diff't parts of the dish repel uneq.	.	. .	¼	. .	.	. .	1	
319.3												
321.4	.	. .	.	. .	.	. .	½&¼					
323.4	.	. .	.	. .	.	. .		. .	.	. .	<1	
325.4	32	. .	.	Not perfectly rep.			.					
327.5	.	. .	.	. .	.	Repelled.	<½					
329.5	.	. .	.	. .	.	. .	.	Not repelled.	.	. .	¾	
331.5	.	. .	.	. .	5	. .	.	. .	.	. .	> ½	
333.6	.	. .	.	. .	.	. .	3½	. .	.	Not repelled.	<½	
335.6												
337.6	.	. .	.	. .	.	. .	4½&2½	Perfectly repelled.	¼&½	. .	½&¼	
339.7												
341.7	.	. .	.	. .	4	. .	3	Not perfect.	> ½	. .	¼&½	
343.8												
345.9												
348.0	.	. .	.	. .	.	. .	.	. .	.	Just repelled.	¼	
350.0												
362.3	.	. .	.	. .	.	. .	.	. .	1			
366.4	.	. .	.	. .	.	. .	.	. .	1½	. .	<½	

The point of maximum vaporization which, with the clean surface, was between 294° and 299°, was raised by oxidation to 317½°, and by an increase in the roughness of the surface to about 348°.

Comparison of Results for Copper.

4. A comparison of the results thus obtained for the vaporization from the surface of copper .07 inch thick, under different circumstances, are contained in the following table; which indicates also, pretty nearly, the relative times of vaporization of the same very small quantity of water under these circumstances.

The temperature of the liquid drops, and the pressure under which they were vaporized, are elements which, of course, it is unnecessary to consider, although it was deemed safer to enter them upon the original notes than to omit to notice them.

Nature of Surface.	Temperature of maximum vaporization.	Time of Vaporizat'n.	Temp. of Repuls.
	Fah.°	Seconds.	Fah.°
Surface highly polished,	292	3	315
„ tarnished,	325½	<1	
„ polished,	328½	2 & 1½	350
„ rough but clean,	296½	¾	
„ oxidized,	317½	¼	338
„ very much oxidized and not clean,	348	¼	

The results thus compared, are probably as accordant as ought to be expected, and indicate the effect of smoothness of surface to be to lower the temperature of maximum vaporization, but to increase the time required to vaporize at that temperature. Thus in the two extremes of high polish and considerable oxidation, the temperatures of maximum vaporization are 292° and 348°; and the times of vaporization 3 seconds and ¼ of a second. The nearness of the point of repulsion to the temperature of maximum vaporization is shown in those cases where the point at which perfect repulsion took place, was noted, nearly; the temperature exceeds that of maximum vaporization by about twenty-one degrees.

Vaporization of Drops of Water by Iron.

5. Experiments were also made to determine the temperature of maximum vaporization of water by iron with different states of surface, and as they preceded those made with the copper, the number of series was more considerable, that care might in a measure supply the place of experience. It will be wholly unnecessary to give the details of each series, since the mode of experimenting has already been stated, and the results can alone be of interest. At the same time, the temperature at which perfect repulsion of the drops took place, was observed. A portion of the experiments were made in an oil bath, others by communicating the heat through tin.

In the following table are the results for a bowl of wrought iron, (No. III,) three-sixteenths of an inch thick; the surface was cleaned with acid and alkali, after each series: it was not very different in smoothness in the different series, until the closing one, which is marked in the table. The oil bath was used in these experiments. The drops of water were let fall from a dropping tube, and one hundred and twenty-eight were required to make one-eighth of a fluid ounce; each drop, therefore, weighed about .45 of a grain.

Temperature of maximum vaporization, and of perfect repulsion, of drops of water let fall upon the sides of an iron bowl, three-sixteenths of an inch thick.

No. of Series.	Surface clean.			
	Temp. of max. vap.		Repulsion.	Remarks.
	Extremes.	Mean.		
First series, ascending			382½	Maximum vaporization passed, at 336½°. Repulsion not perfect at 378½°.
Second series, descending	331½ a 334½	333	373½	Repulsion not perfect at 370½°.
Third series, ascending			386½	„ „ at 385°.
Fourth series, descending	337½ a 341	339	382	„ „ at 378½°.
Fifth series, ascending	327½ a 331½	329½	390	„ „ at 389°.
Mean		333.8	382.9	
	Surface oxidated from use in the foregoing.			
Sixth series, ascending	343 a 350	346½	385	Drop breaks on irregular parts of bowl even at this point, i. e. repulsion not perfect.

The column of remarks in the foregoing table, is intended to contain principally the temperatures at which the repulsion was observed not to be perfect, and gives an idea of the approximation to the true point of repulsion which each individual observation affords. These numbers obviously differ from those for the temperatures of perfect repulsion, less than these latter among themselves, and much less than might have been expected, from the uncertain nature of the effect of slight inequalities of surface.

6. The following table contains another series of results with a thicker iron; they show that the cooling effect in the series just given, was imperceptible, no change in the position of the point of maximum vaporization having been produced by the increase of thickness, that is, by substituting a metal as the source of the communicated heat for an equal thickness of oil. This bowl was very highly heated after the first experiment, so as to cover its surface with a scale of oxide, and the results accord entirely with the similar ones already given, the temperature of maximum vaporization being raised.

Vaporization of water by an Iron bowl one-fourth of an inch thick. Surface cleaned with acid and with alkali.			
Temp. of max. vaporizat'n.		Temp. of repulsion.	
Side drops.	Centre.	Side.	Centre.
337½	358	405	
Scale of oxide by high heat.			
381½		433	456½

In the only other series of experiments with which the committee are acquainted, and which have been directed to the same point, those of Professor Johnson, the point of maximum vaporization is placed at between 304° and 320° Fah. The different nature of the surfaces employed may perhaps account for the difference of this result from that of the committee.

7. The repulsion as developed in solid tin, when heated, was made out from the experiments given below. The figure of the surface of tin was that of the under side of bowl No. VIII. viz. a portion of a spheroid nearly coinciding with a sphere of 3.35 inches radius; the surface itself was tolerably smooth, conforming to the exterior of the iron bowl; there were, however, small irregularities in it.

Table showing the Temperature of Maximum Vaporization for Tin. Surface slightly corrugated.

Centre drops.		Remarks.
Temperature.	Time in Secs.	
276½	1½	Side drops not repelled.
302		
a	¾	
321½		
338		
a	½	
364½		
379	<½	
393	.6	Ten drops in six seconds.
409½	.5	Side drops repelled.
419½	.45	Maximum vaporization.
426	.5	
430	.56	
444	.6	
454	1.5	Tin not melted at surface, though the thermometer is 14° above its melting point below. Thermometer has been compared by the test of melting tin.

The experiments which follow the remark, "ten drops in six seconds," were all made by dropping several drops, not enough however to cool the surface down; measuring the time for the whole number, and dividing by that number. The point of maximum vaporization is placed, with probability, at 419°, the times had certainly increased in rising to 444, but in descending, the same certainty is to be found only on reaching 321½°. This slightly rough but polished surface, as it may be considered, had its temperature of maximum vaporization very certainly above that of the polished copper and of the smooth iron. The time of vaporization of a drop at this temperature was less than one-sixth of the corresponding time for the polished copper, and less than that for the clean copper surface; agreeing more nearly with that for the smooth iron, which was much its inferior in lustre. A correct induction could only be had by varying the number of metals, and by frequent repetition of the results, but so far as these experiments go, they indicate that this repulsion does not depend alone upon the relative polish of the different metallic surfaces.

8. The conclusions which they fairly warrant, are as follows:

1st. With the same metal, the temperature of maximum vaporization of water is lower, as the smoothness of the surface is greater, and the amount of vaporization in a given time at this temperature, is much diminished. In copper, the effect of polish and of oxidation, the two extremes, is shown by a difference in the temperature of maximum vaporization, of 56 degrees, that point being in the two cases, 292 and 348°. Further, the ratio in the times of vaporization at these two points, is as twelve to one, or for the same drop of water, 3 seconds and ¼ of a second. In iron, the smooth surface gave, for the temperature of maximum vaporization, 334, or 337½°, the oxidated 346½°, differing but little from the former; but when highly oxidated, gave 381, or a difference of about 45°, the time of vaporization not differing greatly in the two cases.

2d. The temperatures of maximum vaporization for copper and iron, in similar states of surface, differ between thirty and forty degrees, the iron having the higher point. The time of vaporization at the maximum, is less in the copper than in the iron, in the ratio, probably, of two to one, or nearly in the ratio of their conducting powers for heat, which are as two and a half to one.

3d. The temperature of maximum vaporization, for oxidated iron, or for highly oxidated copper, corresponds nearly to that at which steam has an elastic force of nine atmospheres. But the vapour was formed under atmospheric pressure only.

4th. A repulsion between the metal and water is perfect at from twenty to forty degrees above the point of maximum vaporization, following more closely upon the temperature of maximum vaporization in copper than in iron. At these temperatures, the water does not wet the metal. The drops of water are put in rotary motion in variable directions, and sometimes remain at rest, slowly vaporizing. When very small, they sometimes leap vertically from the surface of the metal. They seem to vaporize from the side next to the metal.

A general view of the facts just deduced, is given numerically, in the following table.

Table showing the Temperature of Maximum Vaporization of Drops of Water in Copper and Iron Bowls.

Nature of the Surface.	COPPER .07 inch in thickness.			IRON 3-16ths inch thick.		IRON ¼ inch thick.	
	Temp. of max. vap.	Time in seconds.	Temp. of repuls'n.	Temp. of max. vap.	Temp. of repuls'n.	Temp. of max. vap.	Temp. of repuls'n.
Highly polished	292°	3	315				
Clean, not polished	296½	¾		334*	383	337½	405
Oxidated	321	½		346½†	385		
Highly oxidated, and not clean	348	¼	338				
Ditto, but clean						381	433

* Mean of three series. Time between 1 sec. and 1½ seconds.
† Time about 1 second for .45 gr. of water.

There can be no doubt that, at the temperatures determined as those of maximum vaporization, an effective force of repulsion between the heated metal and the water has begun to be developed. For we may assume that heat will tend to pass from the metal to the water the more rapidly as the temperature of the former exceeds that of the latter, which would tend to increase the vaporization after the repulsive action had commenced.

The temperatures of maximum vaporization are reached in practice in the high pressure steam engines. The locomotives with flues of copper, use steam of sixty pounds pressure upon the safety valve, corresponding to nearly 306° Fah.; a temperature which is but fifteen degrees below that found for the maximum vaporization by oxidated copper. The iron boilers of our high pressure engines use steam of from ten to eleven atmospheres, or from 354° to 360° Fah., the higher temperature being about twenty degrees below the temperature found for the maximum vaporization of water by an oxidated surface of thick iron.

It is possible, and indeed probable, that pressure may modify these results, all of which were obtained under atmospheric pressure. Pressure, tending to counteract the effect of the repulsion between the heated metal and water, would probably raise the temperature of most rapid vaporization.

Vaporization of considerable quantities of Water.

9. The results already presented, however interesting they may be in a practical or in a philosophical point of view, cannot be said to touch the question of the effect of the contact of water suddenly made with hot metal, in producing explosions. It is necessary to suppose so large a quantity of water, brought under the vaporizing influence of the metal as, except where there is a violent repulsion by the heated metal, to reduce materially the temperature of the surface. To study the question in this point of view, we must ascertain, if possible, the law, according to which a variable quantity of water, thrown upon heated metal, is capable of reducing its temperature, so as to produce the maximum amount of vaporization. That such a maximum may be

found, will be seen by considering the foregoing results. They show that an effective repulsion is developed between water and heated metal, increasing rapidly after a certain temperature, at which the vaporization is a maximum. Now water thrown upon a surface at its temperature of maximum vaporization, would cool it down rapidly below this temperature. Again, if thrown upon it at a temperature when the repulsive effect was very strong, it would not be able to cool it down as low as the temperature of maximum vaporization. Somewhere, then, between the points thus referred to, there will be an initial temperature, at which the vaporization will be the greatest possible, or a given quantity of water will be vaporized in the least time. It is obviously not as easy to solve this problem as the preceding one, nor can so satisfactory results be expected, nor results so constantly reproducible; its practical importance required that its solution should be attempted; and the method adopted was as follows. The same baths, viz. oil and tin, were used as in the foregoing series, to ascertain, generally, the effect of communicating heat through different media. Different metals, copper and iron, with different thicknesses of each, and different states of surface, were subjected to trial. The quantity of water was gradually increased, from small quantities, scarcely capable of reducing the temperature of the surface when the repulsive tendency was fully developed, to quantities as considerable as the bowls could contain. The study of each case was of course attended with much labour. In the greater quantities of water the temperature of the metal of the dishes was so much reduced as to affect that of the bath itself. Accordingly a mean of the temperatures, observed at regular intervals, is taken as the temperature of the bath on which the water was thrown, and which, taking the entire mass into consideration, was supplying an amount of heat due to that temperature, to the parts adjacent to the bowls. The oil bath was stirred to produce as nearly as practicable, a uniformity in temperature in the different parts.

Without knowing the temperature to which the parts of the heated metal, or of its bath, are reduced by the affusion of water, this kind of experiment supplies precisely the answer to the question in practice; *at what temperature of a metal will water, thrown upon it in a limited quantity, be most rapidly turned into steam?* Making due allowance for the different modes of communicating heat in the experiments and in practice.

Copper Bowl, No. VII.

10. The same bowl used in a former series of experiments was again applied, the surface being smooth. This bowl was a portion of a spheriod, approaching nearly, in its inner surface, to a spherical surface of 3.09 inches radius: the versed sine of the segment, or depth of the bowl, was 1.6 inches and its chord, or the breadth of the bowl 5.39 inches. The thickness of the metal was .07 of an inch.

The quantity of water first introduced was $\frac{1}{8}$th of an ounce by weight (60 grains troy,) the water being weighed in a small metallic dish, and thrown into the bowl, placed in the bath. One experimenter observed the temperature of the bath, and gave notice to another of the instant of introducing the water; the other made a memorandum of the temperature and time. The first observer gave notice of the instant at which the liquid began to boil, which was also entered upon the notes. The second then announced each minute, or half minute, as it passed, and the first gave the temperature of the bath at that time, stating also the circumstances taking place in the bowl, when remarkable. The same observer also gave warning when the liquid was about to disappear, and a signal at the instant of its disappearance, which was marked by the second. The time between the introduction of the liquid into the bowl and its beginning to boil is deducted in each case in the following tables, so that they show the times necessary to vaporize the water, after it had been raised to the boiling point. At the high temperatures, the time required to raise the smaller quantities of water to ebullition, scarcely amounted to half a second. The times were noted, usually, by a pendulum beating seconds, sometimes by a quarter-second pendulum.

When a decided repulsion has commenced with these considerable quantities of water, the phenomena are of a very singular kind. The water assumes a rotary motion about an axis perpendicular, or nearly so, to the lowest point of the dish, and at the same time its figure changes, and from being circular in its horizontal section, becomes of an irregular oval, which contracts and dilates alternately as the mass revolves; the transverse axis contracting until its place is occupied by the conjugate, and vice versa. The direction of this rotation is not at all uniform, and the mass sometimes becomes quiescent, and then assumes motion in an opposite direction. When this state of things first begins, vapour sometimes bubbles or bursts up, through the liquid; but when fully established it is most copiously given off from below. In fact, the appearance is that of a stratum of vapour, between the water and the bowl, which becomes, at times, visible, when condensed at the edges.

If the results of the vaporization of one-eighth of an ounce of water, in bowl No. VII. be taken, and a curve be traced from them, of which the ordinates represent the differences between the times of evaporation and a constant quantity, and the abscissæ the differences between the temperatures and a constant quantity, a remarkable regularity will be found in the results, and an approach to a minimum in the time of vaporization. This affords good grounds for attempting to calculate the temperature at which the maximum vaporization, with this quantity of water, would have taken place; or the temperature above which the water introduced would not be able to cool the bowl as low as the temperature of maximum vaporization for drops of water. The obvious approximation of the curve just referred to, see Plate 5, Fig. 1, to the ellipse, induced the trial of the equation of that curve to represent the observations. The following table shows the results of the comparison of calculation and observation, the transverse of the ellipse being assumed equal to 262°, and the conjugate to 200 seconds, and the co-ordinates of the centre being 576° and 211.5 seconds.*

---

* That is, in the equation $A^2y^2 + B^2x^2 = A^2, B^2$; $A = 262^\circ$ and $B = 200$ seconds. $X = 576^\circ$, and $Y = 211.5$ seconds, are the co-ordinates of the centre. So that $x = 576^\circ$ — the observed temperature, and $y = 211.5$ seconds — the observed time of vaporization.

No. of Experiment.	Observed Temperature of Vap'n.	Observed Time of Vap'n.	Ordinates from Observation.	Calculated Ordinates.	Difference.
	Fah.°	Seconds.	Seconds.	Seconds.	Seconds.
1	349.5	116.5	95.	100.1	+ 5.1
2	384.	71.	140.5	135.4	— 5.1
3	420.5	46.	165.5	160.3	+ 5.2
4	452.	32.5	179.	175.4	— 3.6
5	486.	22.	189.5	187.	— 2.5
6	508.	18.	193.5	192.3	— 1.2
7	526.	15.5	196.	195.4	— 0.6
8	537.5	15.3	196.2	196.8	+ 0.6
9	558.	14.7	196.8	198.6	+ 1.8
10	568.	13.	198.5	198.9	+ 0.4

A similar comparison which addresses itself, even more directly to the eye, is given in Fig. 1, Plate 5, in which the upper dotted line is that traced from the observations, and the full line is the ellipse which has been assumed.

The general coincidence of these lines, varying only when the observations are indicated, by the nature of the dotted line, to have been irregular, or the near coincidence of the calculated and observed numbers in the table, and the variable sign of the differences, justify us in assuming the true maximum of vaporization at the temperature corresponding to the highest point of the ellipse; namely, to 576° Fah.

At about 576° Fah. then, a bowl of copper .07 of an inch thick supplied with heat by a medium like oil, would be able so far to resist the cooling action of 60 grs. of water, as to produce the most rapid vaporization; the quantity being sufficient to cover about one-tenth of the surface exposed to heat.

Copper Bowl, No. IV.

11. This bowl was thinner than the last, its thickness being .05 of an inch. Its figure within, approached nearly to a sphere of 3.1 inches radius, the chord of the segment being 5.25 inches, and the versed sine 1.45 inch; it deviated as little, therefore, from the figure of the last as could have been expected from the mode of forming it.

Nine observations were made of the vaporization of $\frac{1}{8}$th of an ounce of water in this bowl, placed in a bath of oil. Of these, seven are shown in the middle dotted line of Fig. 1, Plate 5, and agree very well with the ellipse traced in the full line; the two omitted were at temperatures lower than that of the lowest of the seven included in the figure. The following table shows the comparison of calculation and observation, assuming the major and minor axes of the ellipse to be respectively 251° and 214 seconds; and the co-ordinates of the centre 576° and 254 seconds. These values were not obtained rigidly, but they agreed better than numbers, greater and less, which were also tried.

Fig. 2.

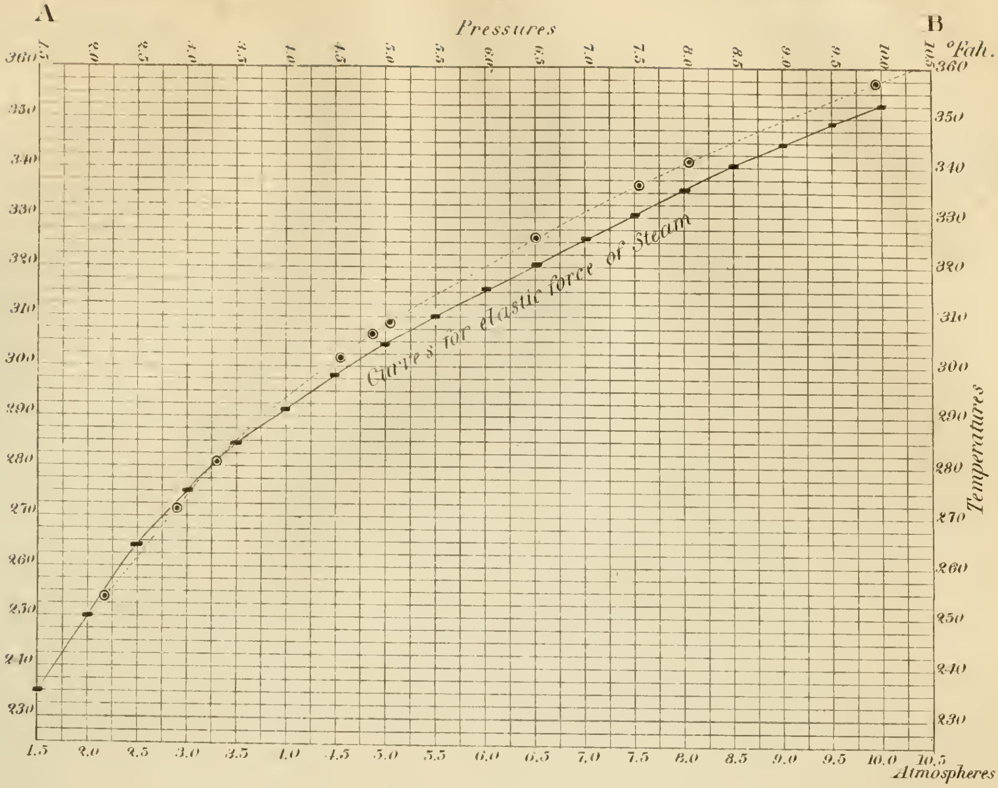

A
B
Pressures
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
°Fah.
360
350
340
330
320
310
300
290
280
270
260
250
240
230
Temperatures
Curves for elastic force of Steam
Atmospheres

Fig 1.

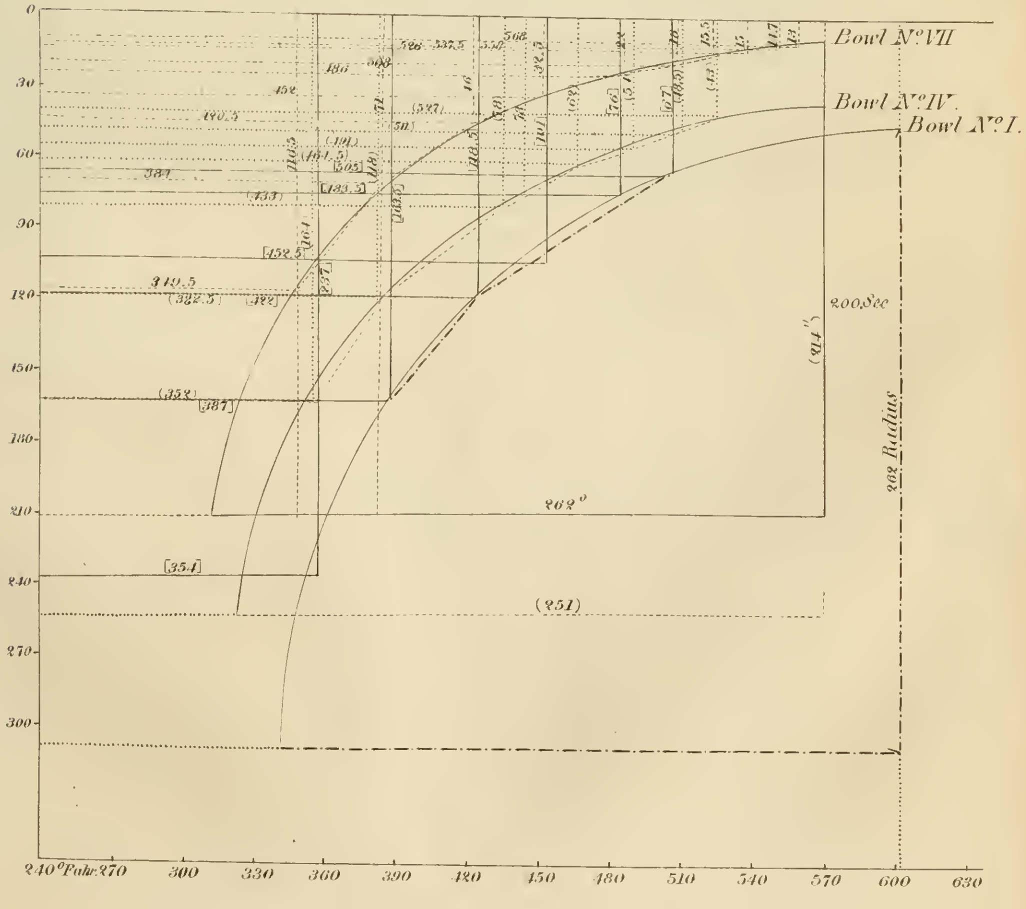

Bowl N°VII
Bowl N°IV.
Bowl N°I.
0
30
60
90
120
150
180
210
240
270
300
526
537.5
550
568
186
300
452
(527)
190.5
(50)
(191)
(164.5)
[505]
384
[133.5]
(433)
[452.5]
349.5
(382.5)
(322)
(352)
[387]
262°
[354]
(251)
200 Sec
(214")
262 Radius
240° Fahr. 270
300
330
360
390
420
450
480
510
540
570
600
630

Fig 1

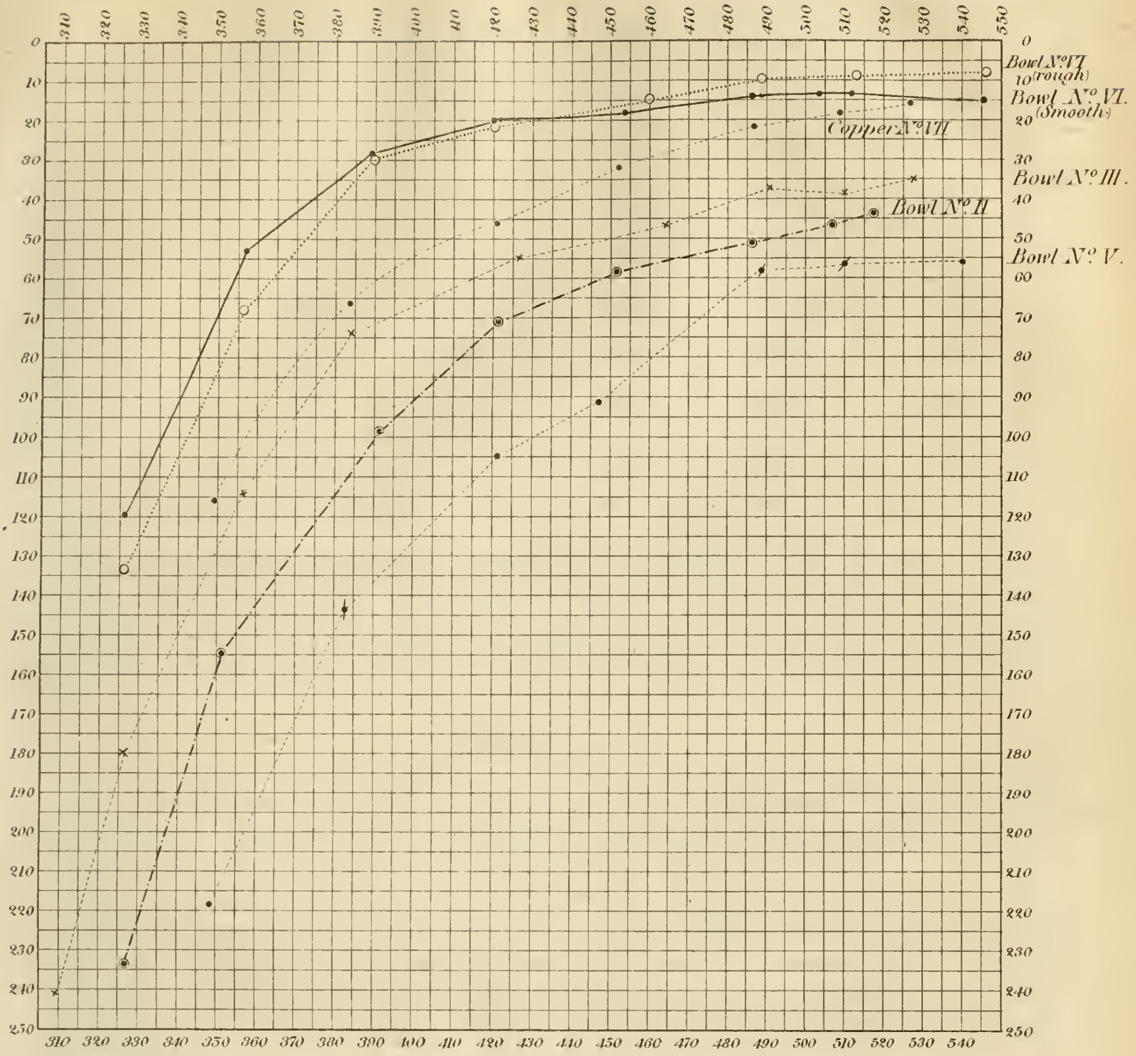
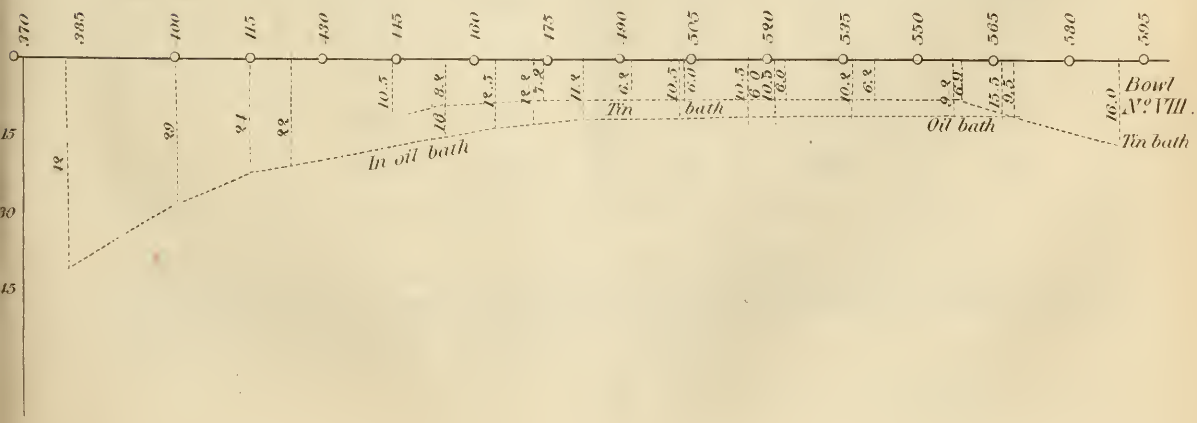

310
320
330
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
520
530
540
550
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
Bowl No. VII (rough)
Bowl No. VI. (Smooth)
Copper No. VII
Bowl No. III.
Bowl No. II
Bowl No. V.

Fig 2


370
385
400
415
430
445
460
475
490
505
520
535
550
565
580
595
15
30
45
12
29
24
22
10.5
8.2
10
12.5
12.2
7.2
11.2
6.2
10.5
6.0
10.5
6.0
10.5
6.0
10.2
6.2
9.2
6.9
15.5
9.5
16.0
In oil bath
Tin bath
Oil bath
Bowl No. VIII.
Tin bath

No. of Observation.	Temp. of Vaporization.	Time of Vaporization.	Observed Ordinates.	Calculated Ordinates.	Difference.
	Fah.°	Seconds.	Seconds.	Seconds.	Seconds.
3	352	164	90	96.6	+ 6.6
4	382.5	118	136	136.3	+0.3
5	433	78	176	176.0	+0 0
6	464.5	62	192	191.8	—0.2
7	491	54	200	201.1	+1.1
8	511	48.5	205.5	206.7	+1.2
9	527	43	211	210	—1.0

The temperature producing the greatest vaporization with 60 grs. of water in a copper bowl .05 inch thick, would be nearly 576° Fah., or about the same temperature as with the greater thickness of .07 inches. The surfaces were nearly alike in the two cases, and both were clean but not polished.

Bowl, No. I.

12. Was thinner than either of the foregoing; its thickness being only .025 of an inch. The figure was nearly the same as the foregoing, and the quantity of water used and nature of the bath were the same.

Of eight observations made and recorded in the following table, five only appear to belong to the same curve; this is seen in the lowest curve, Plate 5, Fig. 1, in which the dotted line represents the curve of observation. These five may be represented by a circle determined from observations 3, 4, and 8, which give for the radius 262. The co-ordinates of the centre are 604° and 309 seconds.

No. of Observation.	Temp. of Vaporization.	Time of Vaporization.	No. of Observation.	Temp. of Vaporization.	Time of Vaporization.
	Fah.°	Seconds.		Fah.°	Seconds.
1	306.5	397	5	422	118.5
2	319	369	6	452.5	101
3	354	237	7	483.5	76
4	387	163.5	8	505	67

The calculations place the maximum of vaporization about 604° Fah., or 28° higher than the temperature shown by the other bowls, an effect due, of course, to the thinness of the metal of this bowl.

Vaporization in Iron Bowls.

13. Similar experiments were made with iron bowls of different thicknesses; No. V. .04 inch, No. II. .08 inch, No. VI. .18 inch, and No. III. of an intermediate thickness between Nos. II. and VI. The curvatures and general dimensions were intended to be those of the copper bowls, from which they in reality differed in no important particular. The radius of No. V. was 3.25 inches, of No. II. 3.1 inches, of No. VI. 2.9 inches; the chord of No. V. 5.2 inches, of No. II. 5.2 inches, of No. VI. 5.2 inches, the versed sine of No. V. 1.3 inches, of No. II. 1.45 inches, of No. VI. 1.6 inches. The difficulty of producing a uniform surface, and of retaining one of any smoothness, for a considerable time made these experiments much less satisfactory than those on the copper; in those with No. V. and No. II. oil obtained access to the cup and vitiated part of the results, and this was also the case at high temperatures with No. I. Small particles of water being thrown out of the dish, sunk below the oil without evaporating, and then in passing into vapour below the surface, threw up the oil with slight explosions. The surfaces were rough but clean, the quantity of water used $\frac{1}{8}$ oz. troy. The curves representing these observations are shown in Plate 6; and through the striking irregularities in the three lower ones, we see the effect of thickness of metal in increasing the amount of vaporization at a given temperature, the curve of No. III. being higher than that of No. II. and of No. II. higher than that of No. V. and we also see a tendency towards a maximum lying above 540° Fah., though, from No. III. and No. V. obviously not far above it. The difficulty of passing the maximum with these thin bowls consisted chiefly in the acrid nature of the vapour given out by the oil, which acting powerfully on the eyes, rendered accuracy extremely difficult, and the effort sustained very painful.

With bowl No. VI. greater pains were taken to smooth the surface, and this was cleaned with alkali, to free it from grease, and then with very dilute acid, which was washed off. The curve given to represent the observations, is altogether more regular than in the other cases, and the maximum was reached between 503° and 512° Fah., much lower than the corresponding point for the thin iron bowls.

If the vaporization by the copper bowl, No. VII. .07 inches thick, be compared with that of No. II. of iron .08 inch thick, it will be found to be much more considerable. In fact the curve traced for the copper bowl is exterior to the curve for No. III. and at the temperature of about 540° Fah. intersects that for the iron bowl No. VI. .18 inch thick. From 350° up to 508°, the time of vaporization in the copper bowl varies from $\frac{3}{4}$ths of that in the iron bowl of the same thickness, to $\frac{3}{8}$ths of the time, at corresponding temperatures. The specific heat of the iron, being slightly higher than that of the copper, bulk for bulk, would tend to keep up the temperature of the former metal, but the conducting power of the copper being more than double that of the iron, would much more than compensate for its lower specific heat.

14. The effect of a surface covered with a thick coating or scale of oxide, may be seen by comparing the dotted line near the full line for bowl No. VI. with the full line. At temperatures below 390° Fah. the scale of oxide diminishes the vaporization considerably, probably by intercepting heat; but when repulsion begins to be developed, the scale acts to prevent it, and thus to raise the temperature of greatest vaporization, and to diminish the time required for vaporization at a given temperature. It will be recollected that this temperature, of 390°, differs but seven degrees from that found for the maximum vaporization of drops from an oxidated surface.

This circumstance will be recurred to again.

Quantities of fluid, varying from $\frac{1}{16}$th up to $\frac{1}{4}$th of an ounce troy, were now used with a view to ascertain the effect of varying the quantity upon the temperature of maximum vaporization. The surfaces were varied also. The results are given in the following table.

Times of vaporization, at different temperatures, of different quantities of water in bowl No. VI., three-sixteenths of an inch thick, in an oil bath.

Temperature. Fah.°	One-sixteenth ounce. Time in seconds.		One-eighth ounce. Time in seconds.		One-fourth ounce. Time in seconds.	
	Smooth.	Rough.	Smooth.	Rough.	Smooth.	Rough.
323						231
324	50					
325					234	
326		69	120	134		
353						134
354	23					
356			53	68	127	
357		28½				
386	11					
387						
388		10½	29			75
389				29		
390					78	
419	9					
420			20	22		
423		7½				
425						46
427					46	
450					38	38
452	8					
453		7				
454			18			
455						
460				15		
461						33
485	8					22
486		7	14			
489				10		
492					26	
502					24	
503			13 ⎫			
504	7 M*					
508		4 M	⎬ M			
511			13 ⎭			
512				9		13 M
516					20	
517	8					
527						15
529					20	
534		5				
538	9					
544					19 M?	
546			15	8 M?		
548						15

---

* The letter M designates the temperature of maximum vaporization.

An examination of this table shows no *proper maxima* of vaporization; the differences in the times between experiments near the points of most rapid vaporization being too considerable to indicate a true maximum in any case. Comparing, however, the temperatures of most rapid vaporization as given by the table, for different quantities of water, we observe that the temperature of the metal, when water was thrown upon it, corresponding to most rapid vaporization, which, with $\frac{1}{16}$th of an ounce of water, was about 504°, was, with $\frac{1}{8}$th of an ounce, about $507\frac{1}{2}$°, and with $\frac{1}{4}$th about 517°, having been raised but thirteen degrees by quadrupling the quantity of water, while the extent of surface of the metal directly in contact with the water was doubled. At these points, in fact, the repulsion between the metal and water was considerable on first projecting both the sixteenth and eighth of an ounce of water into the bowl.

The effect of roughness of surface is to be seen in the three series; the effect at the lower temperatures seems to be generally to diminish the amount of vaporization; and when repulsion would have taken place had the surface remained smooth to accelerate vaporization at a given temperature, raising the point of greatest vaporization on the scale. If this speculation be admitted, the temperature at which the rough and smooth surfaces vaporize equally, is but little above that of the real maximum of vaporization of the metal when the cooling effect of the water is supposed to be entirely destroyed; that is, when the water is thrown upon it by small drops.

A comparison of the first and second series, would place this point at about 386° Fah., the third and fourth, at about $388\frac{1}{2}$°. The fifth and sixth would leave a doubt of its position, placing it by the nearest of two results at about 424°; while, on the other hand, the near approach at a lower temperature would incline us to make the coincidence conform more nearly to the numbers given by the other series, by selecting two less accordant times, at about 388° Fah.

The experiments on drops of water placed the temperature of maximum vaporization in this same bowl at 334° Fah. when the surface was smooth, and at $346\frac{1}{2}$. when rough, no doubt a nearer approximation to the real point of maximum vaporization than that just deduced by the medium of a considerable quantity of fluid.

15. No satisfactory method occurred of ascertaining the temperature of a small portion of a piece of metal of the thickness used in steam boilers and exposed to the action of water, at or below the boiling point, while it received heat from a constant source. It was deemed advisable, therefore, to compare the effects which would be produced by communicating heat through a very good conductor, such as tin in the solid or liquid state, and through an imperfect conductor and circulator, like the thickened oil employed in the foregoing series.

The same bowl was therefore tried in tin and in oil, with the same quantity of water, and with the following results, the bowl being .25 inch thick, (No. VIII.) and the material iron. The curves of observation are traced on Fig. 2, Plate 6.

Table of the times of Vaporization in different Baths.

Temperature.	One-eighth ounce. Time in seconds.		Remarks.
	Tin.	Oil.	
455	8¼	16	Bowl, No. VIII., ¼ inch thick.
465		12½	
473	7¼		
481		11¼	
491	6¼		
502		10½	
504	6		
513	6	10½	
521		10½	
537		10¼	
539	6¼		
555		9¼	
559	6⅞		
567	15½		
568		9½	
591	16		

The irregularity of the series made with the oil bath, throws a doubt upon the maximum obtained, particularly as, with a thinner vessel, the preceding series gives a lower temperature as that of most rapid vaporization, and the recurrence of the same time during a range of nineteen degrees, confirms this doubt.

The temperature of greatest vaporization in the tin was about 508½° and the time but six seconds, while with the oil it was nine and a quarter seconds, as shown in this series, and probably less than eight, as shown in a foregoing series. The temperature of maximum vaporization here given for the oil bath, is 555°, differing 46½° from that for the tin. Somewhere between 559° and 568° the times of vaporization are the same for each bath, the repulsion due to the greater heat communicated by the tin counterbalancing the diminished vaporization from the less heat given by the oil.

This comparison shows that the thickness of metal at which the effect of the material of the bath, or means of applying heat, would vanish, is by no means reached in practice.

16. With a less thickness of metal, this difference in the nature of the bath was of course more striking. In a dish, one-twelfth of an inch in thickness, the vaporization, in a bath of tin, compared with a series made with the same surface, in an oil bath, was as follows:

Iron Bowl No. II., 1-12th inch thick. 1-8th oz. water.			
Surface rough.			
In Tin.		In Oil.	
Temperature.	Time in Seconds.	Temperature.	Time in Seconds.
446°	7½	421°	71
460½	6	452	57
484	6¾	487	51
500	6½	507	47
554	8	517	44
566	8		

The average time of vaporization in the oil bath is rather more than eight times that in the tin.

These experiments, therefore, do not entirely represent the case in practice where heat is communicated by flame, by contact of heated air, and by direct radiation.

The maximum shown by this table lies certainly between 460½° and 500°; the apparent maximum being at 460½°, the maximum given, by omitting the observation at 484°, being about 468°; and that by omitting the observation at 460½°, being about 500°.

The minimum time for the oil bath is obviously not reached; it will be recollected that this is probably as high as 570°, or about fifty degrees higher than the last observation in the table.

The times of vaporization for the tin bath, are nearly the same as those for the bowl of $\frac{3}{16}$ths of an inch thick. In fact the heat may be considered as passing through a very thick tin bowl, to the iron, and kept up by flame beneath a second iron surface; the modifying effect of an additional thickness of the iron bowl is therefore small.

Vaporization of increased quantities of Water.

17. It was now an object to increase the quantity of water introduced into the thickest of the iron and copper bowls until the limit of their respective capacities was reached, so that each part of the bowl to which the heat was applied should have also the cooling effects of the water upon it; the effects of the contact of a large quantity of water with hot metal would be thus represented. The nature of the results could not be expected to be otherwise than general.

For reasons already stated, the tin bath was used to communicate heat, and the projection of small particles of water from the dish was avoided by a rim of tin, which gave free escape to the steam, while it remedied, in a considerable degree, the difficulty just referred to. The temperature of the whole bath was in no case reduced very materially, a constant source of heat being applied below; but the metal which was near the bowl had its heat carried off faster than it could be supplied, and thus the temperature of the bath could show nothing more than the temperature of the bowl at the instant of projecting the water into it. The following remarks apply to the thickest iron bowl, or No. VIII., .25 of an inch thick.

One half a fluid ounce of water reduced the temperature of the bowl from 417° to a little below 212°, or through 205° Fah.

Three-quarters of an ounce, introduced at 504°, cooled the metal of the bowl below the point of repulsion for drops, or through about 120 degrees, the higher temperature of the metal more than compensating for the increased quantity of water evaporated. This bowl contained, up to the level of the bath, nearly three and a half fluid ounces. The surface was oxidated.

The following remarks apply to the temperatures of the metal when the water was first introduced.

The temperature of maximum vaporization for ¼th of a fluid ounce, was above 480° Fah., but probably not very far. Between 569° and 628°, the time of vaporization of the same quantity of water increased from 10 to 20 seconds, or was doubled. The time at the point of maximum vaporization was about 8 seconds. With one-half of an ounce of water the probable temperature of maximum vaporization was about 504°, and the time of vaporization 11¼ seconds.

The different experiments with one fluid ounce of water, by comparison with a series in another bowl, indicated the temperature of maximum vaporization to be as high as 555°. At 518° and at 616° the times of vaporization were nearly the same; namely, 16 seconds.

The temperature of maximum vaporization, for two ounces, was above 600°; at 580° and at 602°, the times of vaporization were the same; namely, 24 seconds.

This quantity was as great as the experiment could be made with, satisfactorily.

From the results we see that the times of vaporization of quantities of water in the ratio of ⅛, ¼, ½, 1 and 2, or of 1, 2, 4, 8 and 16, at the temperatures corresponding to the least time of vaporization, were about as 6, 8, 11, 13, and 22, or as 1, 1⅓, 1⅚, 2⅙, 3⅔, not far from the ratio of the square roots of the quantities, which would have given 1, 1.4, 2, 2.8, 4.

The temperatures of the metal on which water being thrown will reduce it to such a degree, that the entire vaporization shall take place in the least time, increased for quantities varying from ⅛th of an ounce up to 2 ounces, or sixteen times, from about 460° up to 600°. The ratio of the temperatures above 212° was as 1 to about 1⅗, indicating the approach to a temperature of the metal at which any large quantity of water introduced into a thick iron vessel, would be vaporized most rapidly.

This point was elucidated directly by heating a cast iron bowl, half an inch thick, in a charcoal fire; this bowl was of the same figure, nearly, with those already described, it could contain about ten fluid ounces of water. When heated to redness, being still kept on the fire, one fluid ounce of water was introduced, and lasted about 115 seconds: 4 ounces lasted in one experiment, 294 seconds; and in another, 304 seconds; and the red heat was not kept up in the dish: the water was repelled at first.

18. In the copper bowl, No. VII., the thickness being .07 inch, or about .36 of that of the iron, the following results were obtained, the same tin bath being used, and the surface of the copper being smooth.

At a temperature of 465½°, ⅛th of a fluid ounce of water was repelled, the repulsion being perfect nearly to the close of the experiment. This quantity required 175 seconds to evaporate. At the initial temperature of 501° the same quantity required 187 seconds to vaporize it. At the higher of these temperatures, in an iron bowl of nearly the same thickness, but in an oil bath, the maximum of vaporization was not reached.

One-fourth of an ounce required 13 seconds to vaporize it at 469° Fah., and 405 seconds at 529°, at which latter temperature the repulsion was perfect nearly throughout the experiment.

Three-eighths of an ounce vaporized in 12 seconds, at the initial temperature of 471°, and the metal in contact with the dish, was solid. At the initial temperature of 486° the same quantity required 30 seconds, and the repulsion was perfect for 15 seconds.

Five-eighths of an ounce vaporized in 15 seconds, at the initial temperature of 481°, and also at 509½°. The minimum time of vaporization being, probably, between these temperatures.

One ounce vaporized in 22 seconds, at 465½°, as the initial temperature; in 16 seconds, at 486°, and the tin was found congealed beneath the cup; in 17 seconds, at 511½; the minimum time being probably between 486 and 511½.

Two ounces vaporized in 24 seconds, at 511½°, as the initial temperature; in 21 seconds at 526°, and in 22 seconds at 556½°; the minimum time of vaporization being probably at or near 526° Fah.

From these results we see that between 471° and 486° Fah. $\frac{1}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, and 1 oz. vaporized in times differing but little from each other, the range being from 12 to 16 seconds; and that with two ounces, from 511½° to 556½°, the time of vaporization was about four times the least of those just referred to. With quantities of water, varying from one-eighth of what the part of the bowl which was in contact with the bath, could contain, to one-half the capacity, the maximum vaporization was between 471° and 481°, and 481° and 511°, and the entire capacity of that part being filled, raised this temperature only to 526°.

This indicates the energy of the repulsion; for the evaporating surface being increased but about three times, and the water increased eight times, the initial temperature corresponding to the maximum of vaporization was raised but 56°. It shows, further, that with metal at this temperature, eight times the volume of steam was formed in three times the time, when the entire capacity was filled and compared with one-sixteenth of this capacity filled; the quantity of 6121 cubic inches of steam, or nearly 3½ cubic feet having been generated in 42 seconds, at the initial temperature of 526°, the steam having atmospheric pressure.

The copper, which was bright when the experiments were commenced, became oxidated as they progressed, thus tending to raise the temperature of maximum vaporization.

Conclusions.

19. From the foregoing details may be deduced the following general conclusions, which will be found of practical importance.

1st. The vaporizing power of copper, when supplied with heat, by a bad conductor or circulator, such as oil, increases with great regularity as the temperature increases, up to a certain point, the water being supposed thrown upon the copper surface, in small quantities. Copper flues, heated by air passing through them, would be in this condition if left bare of water, and then suddenly wet. This holds with copper $\frac{1}{16}$th of an inch thick, without indication that a limit will be attained by a much more considerable thickness. The temperature at which the metal will have the greatest vaporizing power, is about 570° Fah., or about 230° below redness, according to Daniell.

The law of vaporization of small quantities of water, by a given thickness of copper, is represented with singular closeness by an ellipse, of which the temperatures represent the abscissæ, and the times of vaporization the difference between a constant quantity and the ordinates.

2d. The same power in thin iron, .04 ($\frac{7}{32}$) inch thick, increased regularly, and was at a maximum, probably, at 510°. With thicker metal the power increases more rapidly at the lower temperatures, and varies very little, comparatively, above 380°, with thicknesses exceeding $\frac{1}{8}$th, and less than $\frac{1}{4}$th of an inch; attaining a maximum at about 507° Fah., when the quantities are small; rising to 550°, and much above, as the quantity of water is increased relatively to the surface of the metal which is exposed. Quadrupling the quantity of water, the entire amount being still small, nearly tripled the time of vaporization at the maximum.

3d. When copper of $\frac{1}{16}$th of an inch in thickness, was supplied with heat by melted tin, a worse conductor, and having a lower specific heat than copper itself, the time of vaporization, in a spherical bowl, of quantities varying from $\frac{1}{16}$th to $\frac{1}{2}$ of the entire capacity of the bowl, increased but three-fold, and the temperature of greatest evaporation was raised but 56°, or from 470° to 526°. When the bowl had half of the portion which was exposed to heat filled, the weight of the water was about one and one-tenth of that of the metal.

4th. The times of vaporization of different quantities of water, varying from $\frac{1}{8}$th of an ounce to 2 ounces, in an iron bowl $\frac{1}{4}$th of an inch thick, and supplied with heat by the tin bath, were sensibly, as the square roots of the quantities, at the temperatures of maximum vaporization for each quantity.

These temperatures were raised from about 460° to 600°, by increasing the weight of water about sixteen times, indicating that considerable quantities of water, thrown upon heated metal, will be most rapidly vaporized when the metal is at least 200° below a red heat.

5th. While a red heat, visible in daylight, given to a metal, even when very thick, and supplied by heat from a glowing charcoal fire, does not prevent water, when thrown in considerable quantities, from cooling it down so as to vaporize the water very rapidly, it is much above the temperature at which the water thrown upon the metal will be most rapidly evaporated. Thus one ounce of water was vaporized in 13 seconds, at about 550°, in a wrought iron bowl $\frac{1}{4}$ of an inch thick, and required 115 seconds to vaporize in a cast iron bowl $\frac{1}{2}$ an inch thick, at a red heat. Four ounces in the latter bowl vaporized in about 300 seconds, the bowl being red hot when it was introduced; and two ounces vaporized in 34 seconds at 600° Fah.

6th. The temperature of greatest vaporization, with a given thickness of metal, is lower in copper than in iron, the repulsive force being developed at a lower temperature. With equal thicknesses of iron and copper, the vaporizing power of the latter metal, at its maximum, was, with the oil bath, one-third greater than that of the former, and with the tin bath the power of copper .07 of an inch thick, was equal, nearly, to that of iron, $\frac{1}{4}$th of an inch thick, each being taken at its maximum of vaporization, for the different quantities of fluid employed. As the maxima for the iron are higher than those for the copper, the advantage will be still greater in favour of copper when the two metals are at equal temperatures.

7th. The general effect of roughness of surface is to raise the temperature at which the maximum vaporization occurs, and to diminish the time of vaporization of a given quantity of water at an assumed temperature below the maximum.

8th. Though it has been shown that water thrown upon red hot metal is adequate to produce explosive steam, even when it does not cool the metal down to the temperature of most rapid vaporization, it is not the less true that metal more than two hundred degrees below a red heat, in the dark, is in the condition to produce even a more rapid vaporization of water thrown upon it, than when red hot.

Stationary Temperature of Alcohol on heated Metals.

20. A curious fact was observed in regard to the temperature to which alcohol of the specific gravity .81, containing, therefore, 93 parts of absolute alcohol and 7 of water, could be raised in a heated dish. It is necessary, as an introductory remark, to recall the fact that when the temperature of a liquid is gradually raised, by applying heat to the vessel containing it, a limit is reached when the temperature of the liquid becomes stationary, the vapour given out in boiling carrying off the heat which enters the mass. When alcohol, of the strength above stated, was projected into a bowl heated above the temperature at which repulsion of the fluid takes place, the temperature of the liquid did not rise to its boiling point. In fact, the stationary temperature, instead of corresponding with that of ebullition, was lower as the temperature of the dish was higher. This experiment was made in the course of attempting to infer the probable temperature at which water might be repelled from the more readily attained temperature of the repulsion of alcohol. Not being of direct application to the subject before us, it was not carried as far as in other hands it would deserve.

Temperature of Alcohol vaporizing in a Copper Dish, .07 inch thick.

Temperature of dish.	Temperature of Liquid.	Time of Vaporization in seconds.	REMARKS.
381°	169½		Quantity thrown in not measured, nearly fills the dish.
396	165½		
418½ *a* 409½	165	65	
430 *a* 425½	164	72	
438	164	75	
445 *a* 440	163	85	One ounce of liquid.
441	159¼		
448	158¼		
"	158¾		
"	159¼		
453	157¼		

(*To be continued.*)

Decision of the Circuit Court of the United States, for the Eastern District of New York, in a Patent case involving some important principles. To which is appended some remarks by the Editor.

UNITED STATES CIRCUIT COURT.

Before Judge Thompson.

Henry Stanley vs. Henry Hewitt.

This was an action founded upon a patent granted to the plaintiff, Henry Stanley, by the United States, the 17th December, 1832, upon a specification and application made to the patent office the 11th of October, 1832, for an improved rotary cooking stove. The plaintiff, by several witnesses, proved the originality of the invention in him, its importance and usefulness, and that the defendant had, from patterns taken from the plaintiff's stove, made and caused to be made and sold a large number of stoves, and was still pursuing the business.—The defendant to show that the plaintiff's patent was void; called Elisha Town and his son, and others to prove that in 1823 and 1824, he invented and procured to be cast a rotary stove, and that the plaintiff's stove revolved like it—also a Mr. Gould to prove that the plaintiff took the collars and flues in the cap of his stove from said Gould's stove, and also other witnesses to show that the plaintiff, as well as others, had used the collars and flues long before the plaintiff's improved cooking stove was invented; and also that the defendant attempted to show that the plaintiff had sold his stoves and given his invention to the public before he applied for his patent.

The plaintiff, in reply, called numerous witnesses to show that Town's stove, whatever it was, was useless, and had been abandoned as such; and that the plaintiff had no knowledge of it when he made his invention and improvement, and that his stove, in all the important improvements by him claimed, was wholly unlike Town's stove, and that collars and flues were not claimed by him as his invention, independently of his rotary plate in which they were attached, and that when they were put upon the Gould stove it was done at the plaintiff's suggestion. And that all the stoves delivered out before the application for the patent were delivered to be used on trial and with a view to test the utility of its improvements. The trial was a very laboured one, and occupied five or six days; but finally resulted in a question of law, growing out of the wording of the specification; which appeared to have been drawn up by the plaintiff without proper legal advice.

On the part of the plaintiff it was insisted that the claim, in his summary, was for a combination of certain improvements he had made in the cooking stove connected together and attached to the top or cap of his stove, put in motion; and that it was the combination which he claimed, and not the parts forming the combination separately, and that his specification would bear that construction.

On the part of the defendant, it was insisted that the plaintiff had so worded his specification that it would not bear that construction, and that it really claimed the different parts comprising the top or cap of the stove separately and independently of any combination, and that his specification was otherwise defective.

Judge Thompson, in the progress of the cause, gave his opinion that putting the stoves out on trial and for the purpose of experiment and improvement, was not such a public use of them as would be considered as a dedication to the public—that the plaintiff was justified and had a right to test the utility of his invention, and see what improvements might be made before he applied for his patent, and that this was an article which would be tested by being put into several families, where it might be differently used by different housekeepers.

In charging the jury, Judge Thompson, after stating the case and the difficulties arising from the obscurity of the language employed in the summary of the specification, remarked that in all cases, where consequences of great importance to the parties were involved, the jury must expect that the views of each, would be presented with great earnestness and zeal. Nor is it surprising (said he) that in such controversies, matters not materially connected with the merits of the issue, should be brought before the Court and Jury during the progress of the trial.

These remarks are applicable to the case now under consideration. It evidently involves matters of importance to the parties concerned, and has been accompanied by circumstances having no material bearing upon the questions in issue. *We*, however, are to examine the controversy, and determine it, by the law and the evidence, without reference to extrinsic matters, having no bearing upon its merits. And in this view of the subject, it is of no consequence whether the plaintiff, Mr. Stanley, has, or has not, accumulated a fortune, as the fruits of his invention. If, by his own talents, industry, and perseverance, he has produced a machine, useful in itself, and approved of by the public, he is entitled to the protection of the law, so far as he has rights to be preserved and guarded. And if, on the other hand, he has interposed claims which cannot be the subject of legal sanction, he must abide by the consequences of his fault, or misfortune.

I state to you, gentlemen, in the outset, that this is not a case free from difficulties. But I have the consolation of knowing that my decision of the matter *need* not be final, and that any mistakes committed *here*, may be reviewed and corrected by another tribunal, where I, too, shall have an opportunity of considering the subject with more care.

In my view of the case, much evidence has been introduced upon both sides, which is entirely irrelevant. The plaintiff's rights, whatever they are, depend upon his patent, and if he has any by his patent, and has not abandoned them to the public, he is entitled to protection. I confess to you, that my own prepossessions lean towards useful improvements, and I would construe the patent act with a liberal spirit, and expanded views. It is a beneficial law, having its foundations in public policy. Its object is, to encourage the enterprise of ingenious men, that the results of their labours, being brought into view, may be first enjoyed by the inventors for a limited period, and then dedicated to the public benefit forever afterwards. Nevertheless, I do not mean to say that all patents are to be protected *at all events*, but those only are to be sustained which have the sanction of law. It is a well known fact that patents are granted at the Patent Office, not after an examination into their merits, but upon *ex parte* statements, and hence their real claims may be afterwards investigated with proper strictness in a court of law.

There are some general rules always to be observed while considering this subject. In the first place, to entitle a patentee to maintain an action for a supposed violation of his rights, his invention must be both useful and new; not that its usefulness is to be scanned with a critical eye, to ascertain a given amount of benefit to be derived from it, but the invention must be useful, as contradistinguished from that which is frivolous, or wholly worthless. If not frivolous, or entirely useless, the requirements of the law in this particular are complied with.

With regard to the invention before us, it is clearly useful; this is proved by the testimony of witnesses on all sides. It is proved, also, by the great extent of the plaintiff's sales, by the favour of the public, which has been liberally bestowed upon it, and by the palpable imitations of the plaintiff's models in the case under consideration.

If the plaintiff has legal rights here, there can be no doubt that they have been violated by the defendant. There is no substantial difference between the stove made by the defendant, and that invented by the plaintiff; the one is a copy of the other. And as to the extent of the violations, there is as little doubt. If you believe the testimony of Mr. Randal, the defendant sold a hundred stoves before the commencement of this suit, if his own declarations are to be credited, for he told the witness, in express terms, not only that a hundred stoves like these *had been sold* in Vermont, but that they had been sold *by him*. If this witness, therefore, is worthy of credit, (and he stands entirely unimpeached in every respect,) there can be no doubt that the plaintiff's rights have been violated by the defendant, if, in fact, it shall appear that he has any which the law can protect.

But the great question is, whether he has any such rights, and the solution of that question is to be found in the patent itself.

And here I may remark, that much has been proved and said in relation to the inventions of Town and Gould. The evidence upon these points is only important in one point of view, and in that it will be here considered. It shows that the materials, or component parts, of Stanley's stove are not in themselves *new;* and if the plaintiff claims a combination of things, he has evidently taken old materials to form his machine with, whatever it may be.

In relation to this part of the case, I would observe, that the particular words used in the specification and summary of this patent are of no importance. The office of words is to convey ideas, and our province is to determine what the party intended to express by the language employed. Did the patentee intend to claim the discovery of a *principle*, in the abstract or philosophical sense of that term? or did he intend to describe a contrivance, or machine, new and useful in reference to the purpose for which it was produced? He claims in his summary, "*the* revolving top plate," as a constituent part of his invention, and the first inquiry is, whether, before the use of Stanley's stove, a contrivance had been used by which the utensils to be heated had been brought over the fire, by means of a top revolving upon its centre. If the patentee claims this revolving *motion* as his own discovery, in its application to a cooking stove, he evidently includes in his patent that which is not his own discovery; for Town's stove had a revolving top, or drum, intended to accomplish the same object, by means somewhat similar.

It is very possible that Town could not maintain a patent for that invention, because he long ago gave it up, and abandoned it to the public. He did not, however, abandon it to the *plaintiff*, and all other persons might use it as well as he. If Town's discovery was abandoned, the only claim to it which Stanley can maintain, is the use of the thing as a part of his combination; and here we must determine what Town's invention was.

It is evident that he invented a revolving drum or top of a stove, to convey vessels to and from the fire by a rotary motion and concentrate the heat around them when placed there. This contrivance he gave up, or abandoned, because it was useless, that is, useless in its then combination, though not in the abstract—for the principle or contrivance, as to the revolution, remains. As a cooking machine, the stove of Town was good for nothing; but its revolving motion might be made useful when brought in connexion with other constituents properly adapted to the objects in view.

The same remarks are applicable to the raised cones, or collars, and the flues. Each of these was old, and each had before been used either by itself or in other combinations. Stanley himself had used the collars in his own stove, as far back as the year 1828. So had Wilson—and this part of the machine is confessedly old. So with regard to the flues. If Stanley was the inventor of these, he had abandoned them to the public long before the date of his patent, and he cannot, therefore, now claim them as the subject of a patent. But the question is, whether Stanley *does* claim these materials or constituents as his invention?—for if he does his patent is void. He would then claim as his own the discoveries of others, or endeavour to maintain that which he had, by use, dedicated to the public.

If, on the other hand, the patentee claims a *combination* here, and nothing more, then I have no hesitation in saying that his rights are secured. If he goes for the elements or constituents of his machine, his patent is void, but if he merely claims a new combination of old materials, his rights may be protected. The patent itself is somewhat obscurely drawn, but the invention is useful and meritorious, and I am disposed to give it all the protection which the law will allow. A liberal construction should be given to these instruments, nor should a severe criticism be bestowed upon language used, for the most part, by the inventors themselves, who are, in many cases, altogether unskilled in the use of technical terms. We are always to ask ourselves on these occasions, what was the intention of the writers, and if that be discovered, the particular words used are altogether unimportant.

With these views, and under these considerations, I proceed now to give you my notions as to what this patent contains. It concludes with a summary in the following words:—" the *principle* for which I claim the invention, and for which I ask letters patent," is " the revolving top plate or fixture into or on which are placed the principal utensils used in cooking," &c.

By the patent law, the party is required to describe that which he makes, that the public may understand *the thing*, and be able to construct the like after the patent shall have expired; and hence there is a necessity for a proper observance of this requirement of the act. In this case, the plaintiff claims the specific thing set forth in the summary, and we must turn to the specification in order to understand what that thing is. The term used in the summary is "principle," but a reasonable interpretation must be given to it, or no sensible exposition of the parties' meaning can be obtained. He evidently did not intend to claim the discovery of an abstract thing, or entity, but some tangible mechanical contrivance, described in the specification. By "*principle*," he evidently intended a contrivance or thing described; and as there is no magic in words, we may fairly give this interpretation to the term used.

The plaintiff then patents *this* "revolving top plate," with its collars and flues, but instead of describing his invention as it really is, a *combination*, he describes the constituent parts. His improvement consists of a combination, and he should so have described it, and I have no doubt that a specification may be drawn which will secure all his rights. If the plaintiff had properly described his invention as it actually exists, his patent would have been good, for then the combination would have appeared.

But, in order to help out this part of the case, the drawings have been referred to. They show the combined thing, it is true, but the specification is silent as to the drawings, which are not necessarily to be taken as a part of it. If the specification itself made reference to the drawing, then they would become a part of it, and might be referred to for the purpose of elucidating any thing obscure in the description. But here the description is perfect without a drawing, and most probably a mechanic could make the contrivance, without resorting to the drawings at all, for explanation. The specification very clearly describes the revolving top plate, part by part, and in the summary, the plaintiff claims the entire thing described,—not as a combination, but as consisting of constituent parts, which he himself had discovered. Here lies his error, and upon this ground his action must fail. That my views on this subject may be clearly understood, I adopt the language of Lord Eldon, in the case of Hill vs. Thompson, [3 Merival's Rep., p. 621,] as containing what I consider a concise summary of the law on this point. He observes that "the judge, in his direction to the jury, has stated it as the law on the subject of patents, *first*, that the invention must be novel; *secondly*, that it must be useful; and *thirdly*, that the specification must be intelligible. I will go further, and say, that not only must the invention be novel and useful, and the specification intelligible, but also that the specification must not attempt to cover more than that which, being both matter of *actual* discovery, and of *useful* discovery, is the only proper subject for the protection of a patent. And I am compelled to add, that if a patentee seeks by his specification any more than he is strictly entitled to, his patent is thereby rendered ineffectual, even to the extent to which he would be otherwise fairly entitled. On the other hand, there may be a valid patent for a new combination of materials previously in use for the same purpose, or for a new method of applying such materials. But, in order to its being effectual, the specification must clearly express that it is in respect of such new combination, or application, and of that only, and not lay claim to the merit of original invention, in the use of the materials. If there be a patent both for a machine, and for an improvement in the use of it, and it cannot be supported for the machine, although it might for the improvement merely, it is good for nothing altogether, on account of its attempting to cover too much."

After a full view of this case, I am compelled most reluctantly to come to the conclusion that the plaintiff has undertaken to secure more than he has a right to claim, and in my view of the law he cannot recover. He should have patented his combination, and not his constituent parts. I regret this result the more because I consider that the plaintiff has invented a machine or contrivance, ingenious in itself, and highly useful for the purposes to which it is to be applied. I would protect him if I could conscientiously do so, under the views of the law which I have taken, and I consider the whole matter rather as a question of law for the court, than as a question of fact for the jury. If, however, the parties prefer to go to the jury upon any of the matters in issue, they have a right to take that course—but I would choose, if I could, to put the cause in that shape which would be most likely to secure the plaintiff's rights, if I have mistaken the law applicable to the case, or given an incorrect construction of the patent.

[The plaintiff voluntarily submitted to a nonsuit, with leave to move to set it aside hereafter.]

Note.—The above opinion expressed to the jury in said cause, was taken down at the time by one of the Counsel for the plaintiff—was then shown to Judge Thompson, by him examined and approved, and is published as corrected by him. S. P. STAPLES.

S. P. Staples, J. P. Hall, and J. R. Staples were for the plaintiff.

R. M. Sherman, of Connecticut, Hugh Maxwell, Mr. Ormsby, of Rutland, Vt. and Mr. Harris of Albany, were for the defendant.

Remarks by the Editor.—It is truly gratifying to those who take a deep interest in the progress of the useful arts, to witness the change which has taken place within a few years in the tone of the decisions of the courts both of this country, and of England, where the rights of patentees have been concerned. Several of the judges in both countries appeared, formerly, to partake of the popular prejudice against patentees, as monopolists, whose claims ought, if possible, to be resisted; and many patents have been vacated upon grounds which we believe would now be generally deemed frivolous. It is not improbable that the name of "the Statute of Monopolies" by which the law of the 21st of James 1st, was designated, might itself have contributed towards the producing of such a result. At all events we consider the fact as notorious, and the difference at the present day as perfectly manifest. The foregoing report may serve to illustrate the position, which, were it necessary, might be sustained by numerous examples.

The patent laws of England, and of this country, are based upon the same principles, and the decisions of the English courts are, in consequence, cited in ours; there are, however, some provisions in our statutes, not contained in the British, and these of course, must govern our courts in those points to which they relate, and it has appeared to us that in one particular of this description, the foregoing decision may be considered as in some degree defective.

In the English statutes there is no provision whatever making it necessary to accompany the specification of a patent for machinery with drawings. "It was also formerly considered that the words of a specification ought of themselves to be sufficiently descriptive of the improvements, that the specification ought to contain within itself all the necessary information, without the necessity of having recourse to a diagram; and that if a diagram were given, it ought to be merely taken as an illustration, and not constituting a principal, or essential part of the specification; and therefore that a person was not bound to look at the diagram to learn the invention. But a very learned judge has however held that if a drawing, or figure, enable a workman of ordinary skill to construct the improvement, it is as good as any written description." Godson on patents, p. 119, edit. 1823. In the act of Congress of Feb. 21st, 1793, sec. 4, it is provided that the patentee shall not only describe his invention "in such full clear and exact terms as to distinguish the same from all other things before known," but also that "he shall accompany *the whole* with drawings and written references where the nature of the case *admits* of drawings." Under this provision we cannot resist the conviction that in every thing which *admits of drawings*, these drawings and written references, imperatively required by the statute, do make a component and necessary part of the specification, and that they are not to be taken as merely an illustration. In the drawing up of specifications of things which "admit of drawings" it would always be advantageous to refer to them in the body of the specification, and the only reason for omitting this is to save expense, as, in such cases, two copies of the drawings are required, one to attach to the patent, and the other to remain in the office. The practice of the office, and not the requirements of the law, has made a copy of the specification a component part of the patent; this practice arose from the impossibility of carrying that part of the law into effect, under a literal construction of it, which requires that the patent shall contain "a short description of the said invention, or discovery." A specification which is without written references to drawings, might be considered as fulfilling this intention; but not so where it contains within itself references to the drawings, as it could not, in that case, be undersood, without attaching these also to the patent.

There are some points relating to this subject which we have left untouched, although we think them of much importance, but more space would be required for their investigation than it is thought proper to occupy at present, and they are therefore omitted.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On making Sugar from Plants which thrive in the Temperate Zone, and north of the Climate where the Sugar Cane can be cultivated with success.

The article Sugar, strictly considered, ranks amongst the luxuries of life; but its pleasant taste, good qualities, and our habit of using it, has made the luxury a necessary article to a very large portion of the citizens of the United States.

Through various channels, the public are informed, that in consequence of measures adopted into the colonial policy of foreign nations, the process by which sugar has heretofore been produced, will be much deranged, and the supply greatly diminished.

The only concern that the Franklin Institute has with measures of this kind is, to bring scientific power to bear upon them, so as to reduce to its lowest point, their tendency to do ill, and to carry their capacity of doing good to its maximum. If the change of colonial policy, that is spoken of, should lead to a diminished supply, this will be followed by an increased price; and much privation of comfort must be experienced, until people acquire the habit of doing without sugar, should no new mode be discovered by which the article can be produced.

In this stage of the business, there is a propriety in the Franklin Institute turning its attention to making the citizens of the United States acquainted with what has been done in producing Sugar from plants growing in forty-eight degrees of north latitude. It is impossible, at this time, to appreciate the value of the services conferred on society, by the labours and discoveries of the French chemists, who have shown to the world, that a supply of sugar is to be had from plants growing so far north. These discoveries will prove one of the great scientific victories that characterise the chemistry of this age.

Translations of all that has been published in France, on this subject, if presented to the patrons of the Journal of the Franklin Institute, would be of great value, not only to them, but to the whole nation; the information contained in the French treatises, will be rendered still more valuable, if they are followed by essays from men of science, in our own country, who are acquainted with its soil, climate, agricultural and manufacturing resources. Although the natural circumstances of the United States, evidently are favourable to this branch of agriculture, the subject has had little, if any attention bestowed upon it, we are almost ignorant of all that has been done or written about it.

The beet, and some other sacchariferous roots, when cultivated in France, mature their saccharine juices so perfectly, that they admit of chrystalization. There is every reason to presume that the same plants, with equally good cultivation, would advance to higher perfection throughout the

United States; and this greater perfection must be the result of our warmer summer.

The weight of beets and roots that might be grown to make Sugar from, is so great, that the sugar farmer, in most instances, would necessarily become the sugar maker; be his own chemist, and have his own laboratory: for in fact, the planter's sugar house is a laboratory,—only that the Pennsylvania and Ohio sugar house will differ from the Jamaica one, by having for a companion, the English cow-shed; for it must be recollected that the refuse or pulp of beets will feed cattle, whereas the squeezed cane is worthless trash.

The readers of the Journal will see that the present paper has solely in view to awaken their attention to a subject of great importance, in its relations to agriculture, manufactures, commerce, and the comforts of society. This is only doing what the Institute, on former occasions, has effected, through the publications in the Journal, by exhibitions, and by premiums. By these means, it has brought forth the energies of men of talents, and the result has been the supplying ourselves with many things, the want of which would now be felt, as a very great calamity. J. R.

January 12, 1836.

Remarks and Inquiries respecting Mr. Avery's Patent Steam Engine.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir—You have doubtless seen in a late number of the New York Mechanic's Magazine, (the one for September I think) an engraved drawing of "Avery's Rotary Steam Engine," accompanied by a description. It is generally believed that this engine has been *secured* to Mr. Avery by patent. I have always supposed the main object of the patent law to be, the *protection* of *original inventors* in the enjoyment of whatever pecuniary advantages they may fairly derive from their useful inventions.

That Mr. Avery's engine, or one constructed upon the same principle of action, though perhaps somewhat different in detail, will be found in some situations a convenient and economical machine, I do not doubt. Indeed, I know some persons who would like to make use of such engines, but who are, some of them unable, and all unwilling, to pay Mr. Avery for the privilege of doing that which they feel themselves equally at liberty to do with himself. My reasons for doubting the validity of his patent, may be found, *first*, by referring to the September number of the New York Mechanics' Magazine for 1833, in which is given a drawing and description of the beautiful contrivance of Hiero, the first account of which is said to have been published in the year 1571.

The principle upon which Mr. Avery's engine acts, will, I think, be seen at a glance, to be the same as that of Hiero's. *Secondly*, in a work by Oliver Evans, entitled the "Young Steam Engineer's Guide," published by Carey & Lea, page 93, the biographer of Mr. Watt, speaking of his first attempt to produce a direct circular motion by steam, says, "he (that is, Mr. Watt) then tried Parent's or Doctor Barker's Mill,* inclosing the arms in a metal drum which was immersed in cold water; the steam rushed rapidly along the pipe which was the axis, and it was hoped that a great reaction would have been exerted at the ends of the arms, but it was almost nothing, the reason seems to be that the greatest part of the steam was condensed in the cold arms It was then tried in a drum kept boiling hot, but the impulse was now very small in comparison with the expense of steam." Upon this experiment Mr. Evans remarks as follows: "It is evident from this account that Mr. Watt has used *weak steam*, and placed dependance on the use of a condenser; had he in his experiment with Doctor Barker's Mill, lessened the apertures by which the steam issued, so as to confine the steam until the power in the boiler was equal to 100 lbs. to the inch, he would have been astonished to see it revolve about 1000 times a minute, supposing the rotary tube to have been three feet in length; I have tried the same experiment, but without the least hope of success, on any other principle than by confining the steam to increase its elasticity to a great degree. My rotary tube was three feet long, the elastic power of the steam about 56lbs. to the inch; it revolved with a velocity of about 700 to 1000 times a minute. The aperture by which the steam issued about $\frac{2}{10}$ of an inch diameter; it exerted more than the power of two men, and would answer to turn lathes, grindstones, &c. when fuel is cheap. I have specified and explained it in the Patent Office." Unfortunately, there is no date to this work of Mr. Evans, but I presume it can be readily ascertained in Philadelphia, when it was published, and probably when the specifications were entered at the Patent Office. But that it was done long before Mr. Avery's engine was thought of, I think there can be little room for doubt, as it appears from another part of the same work of Mr. Evans, page 96, that he *matured* his experiments upon the application of steam to a wheel, in the year 1784, which, as he states, he described in the Patent Office.

---

* Descriptions of Barker's Mill may be found by your readers, in Ferguson's Lectures, Nicholson's Operative Mechanic, and almost every reputable work on Mechanics now in use.

Under these circumstances, I cannot see what possible claim *Mr. Avery* can have to a patent for this invention; as to the drum which encloses the arms as represented in the drawing of his engine before referred to, I understand it is claimed as having been first applied to it, by a Mr. Clark, of some western town in this state.

By giving the foregoing an *early* insertion in your Magazine, you will sir, *essentially* oblige several of the friends and readers as well as promote the cause of justice. Should you be willing to express your own opinion as to the merits of this question, it would be deemed particularly valuable.

FAIR PLAY.

Remarks on the foregoing Communication, by the Editor.

It so happens that "Fair Play," and others, who desire information on the subject of Foster and Avery's Reacting Steam Engine, (commonly called Avery's) will, in the present number, have a full opportunity of seeing what constitutes the claim of these gentlemen to a patent for an improvement in this machine. They were fully informed respecting what had been attempted with engines similar in construction to their own, previously to their obtaining a patent; and it will be seen that they have confined their claim to improvement within very narrow limits, and so far as we are informed, their claim is a valid one. It may be said that their improvement is trifling; that, however, is their own concern, as those who do not need it are at full liberty to use the machine in any of the various forms which had been previously given to it, or to devise others which are new, without buying from them what may be deemed unimportant.

We are not sufficiently well informed respecting the comparative results obtained from Avery's and the reciprocating, or Avery's and other rotary engines, to make up our minds respecting its real value; between four and five years, however, have elapsed since this engine was patented, and it has been at work at Syracuse, and various other places, during the whole of that time, so that those who have seen it, and who possess a competent knowledge of the subject, have had time enough to investigate it. Before the patent was obtained, we expressed to Mr. Avery, our general want of confidence in the real value of such engines, and our doubts respecting the importance of the improvements claimed; and we did not suppose that the career of the one in question would extend to two years, a length of life, greater than has usually fallen to the lot of rotary engines; it still lives, however, maugre our anticipations; and all the reports which we have received relating to it, tend to show that it has not yet exhibited the first symptoms of decline. Although we still adhere to the opinion, that upon a full comparison, the economy of a good reciprocating, will be greater than that of any rotary engine that has been, *or will hereafter be*, made, we most cheerfully confess that we have a much better opinion of Mr. Avery's, than we at first entertained; and, as to our wishes, they are that by the operation of this, and a hundred other contrivances, which we have esteemed of like value, we may be put entirely in the wrong; let the fact be well established, and we would be the first to make it public. Without putting in an undue claim to the *suaviter in modo*; we have sometimes thought that the tendency of onr animadversions upon patented inventions was to place us in the situation of "The best good-natured man, with the worst ill-natured muse;" it must be recollected, however, that we stand between the claimants of exclusive privileges, and the public.

With respect to the amount of novelty necessary to security, as a foundation for a patent, we think that the fair test of this is the utility of the improvement; if it renders that valuable which was of little comparative worth, it is enough, although it be no more than the addition of a screw, or of a peg. The views which we have adopted upon this subject, may be found at large in Vol. 8, p. 411 of this Journal. The article is a borrowed one, and well worth perusal. "The main object of the patent law is the *protection of original inventors* in the enjoyment of whatever pecuniary advantages they may fairly derive from their useful inventions," and in attaining this end, it is not possible to test them by comparative weights, or to measure them by any established scale; absolute quantity, however small, is all that can be required.

Civil Engineering.

Report to the President and Managers of the West Philadelphia Rail Road Company, by H. R. Campbell, *Civil Engineer.*

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen—I am directed by the President and Managers of the West Philadelphia Rail Road Company, to request the insertion in the Journal of the Franklin Institute, of the Report of their Engineer, accompanied by a map of the road.

This report contains some facts respecting the superiority of the Locomotive Engines made in this city, over those in use on the Columbia Rail Road which were imported from England, that are highly creditable to the state of the arts in this country, and ought to be made known as extensively as possible. The work on the West Philadelphia Rail Road is in a forward state, and will be completed within the period contemplated.

Very respectfully, your obedient servant,
THOMAS FLETCHER.

To the President and Managers of the West Philadelphia Rail Road Company.

GENTLEMEN—I have the honor to report, that the line of the West Philadelphia Rail Road, has been located in conformity with instructions received from the Board. The ground over which it is traced is well adapted to the construction and grade of the road. The excavations and embankments are generally light, and by no means of an expensive character. But few small streams are crossed, and consequently but few culverts and bridges will be required, which will be built of stone in the most permanent and durable manner. In the location of the route particular care has been taken to avoid curves, and no curves have been made upon a less radius than four thousand feet.

The maximum rise of the graded surface of the road, is 46 feet per mile, which is only one foot per mile more than the maximum grade of the main line of the Columbia and Philadelphia Rail Road. A small portion of the line is level, and about one and a half miles are graded at 38 feet per mile. The average grade is $43\frac{3}{10}$ feet per mile, its length being $7\frac{1}{2}$ miles, and total rise 325 feet.

From its juncture with the Columbia Rail Road, a short distance below the Buck Tavern, the route is nearly straight to the Market Street Permanent Bridge over the Schuylkill River, and more direct than the main line of the Columbia Rail Road. By its completion a new outlet will be opened to the travel and transportation of the Columbia Rail Road, and the inclined plane at Belmont will be avoided. The distance from the city of Philadelphia to the head of the inclined plane is about 4 miles; the nearest point to which locomotive engines can approach the city. By the West Philadelphia Rail Road, locomotives can carry their trains to the line of the city proper, at Market Street Permanent Bridge, and to the tide water of the Schuylkill opposite the city.

Trains of cars by this route, propelled by locomotive engines, will gain one hour in advance of those which pass over the inclined plane, by the main route of the Columbia Rail Road. This circumstance is alone a sufficient inducement to divert the travel and a large portion of the transportation from that Rail Road. Statements have been made in the public papers, since the commencement of the West Philadelphia Rail Road, that the construction of a line was contemplated by the Canal Commissioners of the State, by which the inclined plane is to be avoided, without exceeding a grade of 25 feet per mile, and an increased distance of two miles It is due to the stockholders of the West Philadelphia Rail Road and to the public, to state, that no such route exists, and that the name of the engineer, given as authority upon which the statement was made, was used without his permission or consent.

The importance of avoiding inclined planes upon roads constructed for the accommodation of passengers traveling, is beginning to be justly appreciated. By reference to the recent report of the Baltimore and Ohio Rail Road Company, it will be found, that measures have been taken by them, to abandon those parts of their road upon which inclined planes have been constructed, and to construct new lines upon which locomotive engines can ascend without the aid of stationary power. By experiments made on the Columbia Rail Road with locomotive engines, the question has been settled, that 45 feet per mile, is an inclination upon which that species of power can be applied with more advantage than any other. The fact, that the original design was abandoned, of adopting stationary engine power on the Rainhill and Sutton inclined planes of 55 feet per mile, on the Liverpool and Manchester Rail Road, in England, to the more advantageous use of locomotive engines, might also be adduced as evidence, that even steeper grades, may be safely adopted.

The locomotive engines on the Columbia Rail Road, which were manufactured by Mr. Baldwin, of Philadelphia, carry trains of 20 and 24 cars, containing each three tons of merchandise, up 45 feet grades at 10 to 12 miles per hour; while engines of English constructure, from the works of Robert Stephenson, Esq. the celebrated engineer, carry upon the same road only 14 cars, at the same rate of speed. This great difference is produced by the superior arrangement and mechanical application of power to Mr. Baldwin's engine, and not from any difference in the weight and *adhesive* power of the respective machines.

It has been clearly ascertained that Mr. Baldwin's engines, under all circumstances, are able to generate more steam than is adequate to overcome the adhesion of the wheels upon the surface of the rails, while those of English construction are unable to keep up a sufficient supply. These facts are mentioned as evidence of the progressive improvements in the science and construction of locomotive engines, and of the perfection to which their manufacture has arrived in our own country. The durability of these engines, and the amount of annual repairs, are not less striking than the result of their effective force.

Enough, it is presumed, has been said to prove conclusively, the superiority of the route of the West Philadelphia Rail Road, over that portion of the Columbia Rail Road which it is destined to rival. With regard to the comparative distance of the two lines, the former is about half a mile shorter than the latter, from the intersection of Broad and Market Streets. The whole cost of the West Philadelphia Rail Road, including a double track of edge rails, laid on foundations of locust timber, will be $250,000. The work is all under contract and rapidly progressing to completion.

The grading will be finished by the 1st of May, 1836, and the rails will be laid ready for travel by the 1st of August following. Contracts have been made for iron edge rails, of a pattern similar to those of the Camden and Amboy Rail Road, to weigh 60 lbs. per lineal yard, and also for all the materials necessary to complete the work, which are to be delivered in all the month of April next. The Board have every reason to be satisfied with the progress of the work under the respective contracts. The prices are generally fair, and no obstacles exist to the completion of the road within the time specified in the contracts.

H. R. Campbell,
Engineer of the West Philadelphia Rail Road.

Philadelphia, October 15, 1835.

Physical Science.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Experiments on Endosmosis. *By* JOHN W. DRAPER, M. D. *Christiansville, Mecklenberg, Va.*

1. The interstices which exist in a great variety of bodies, may be looked upon as a large system of capillary tubes, into which we should be prepared to expect, that bodies of all kinds might pass. A drop of water, placed upon a porous stone or chalk, sinks into it rapidly, but the value of the observation is lost, because it is common. If that water contained a colouring matter, we should find that in sinking into the chalk, the colour would be left on the surface. But here again common place principles dictate a ready answer, the interstices of the chalk may be supposed to be too small, to admit the colouring matter to pass, or perhaps some incongruity of shape might afford a barrier; yet, how upon these principles shall we explain, that mercury and other bodies remain unmoved upon the porous mass, and show no ability to go through it, when they will pass with readiness into the densest and closest substances, as gold. No principle of coaptation will explain why quicksilver will not rise in a tube of glass, or why water rises at all. We are thrown at once to refer the whole matter, to the the chemical conditions of the bodies on which we operate, and we quickly infer, that fluids do not pass into pores by soaking or leakage, or any such commonplace principle, but that it is an action determined by certain laws that have reference to the condition of each body, separately, and their relation to each other. A question therefore naturally arises, as to the peculiar operation of those pores, and how changes in their position, size and shape, would affect the results of their action. A class of these phenomena is quite independent of pores of any sensible size, when no leakage or oozing can be suspected. A piece of sugar dissolving in water, diffuses itself into every part of the menstruum. Among those excessively small interstices, that exist between the least atoms of the water, its particles find a dwelling, where they are sheltered from all those forces that act so energetically on the great masses of matter. Independent of gravity, they move freely in every direction, and far from settling in those positions to which they might tend from their weight, they are simultaneously and equally found, in every portion of the solvent. This condition of things does not indicate a passive state, but would rather teach, that a very active and powerful force is in operation, a force that can neutralize the action of gravity, and other external agents. It is essential, therefore, clearly to understand the circumstances of this absorption; it may take place independently of apertures, pores or vessels, it may take place between gases and gases, gases and vapors, or liquids, or solids, or mutually and indiscriminately among them all.

2. When a liquid rises in a capillary tube, only those portions are under the direct influence of the attractive force of the tube, which are nearest to it; the central columns being entirely unaffected. Also, when water jets out through a narrow pipe, it is only those portions that are directly in contact with the sides of the pipe, that are subject to its resisting influences, any disturbance which the central particles feel, arising only indirectly from their cohesion. The same applies in the passage of liquids among pores, the diameter of these pores amounting to a certain size, they will admit a pas-

sage, without exerting any direct influence. Thus, a pore in a piece of charcoal, may suffer a column of water to go through it, without in anywise affecting the central portion of that column, by reason of its size, but should the diameter of the pore be made to decrease, it is obvious a limit might finally be reached, where every particle that passed, should come under the direct influence of the physical force exerted by the pore, and none pass by mere leakage, or oozing.

3. This leads us to consider the different effects that may ensue when the same liquid or gas passes through pores of various sizes, in the same solid. An example may perhaps illustrate the results. The walls of a pore are so constituted, as to allow an easy passage of one gas, as oxygen, along them, and afford more or less resistance to another, as nitrogen gas. Now, if we suppose this pore to be of very large size, and atmospheric air to be passing through it, little or no change will happen, in the constitution of the passing gas, all the internal parts of the current being out of the reach of the walls of the pore; but should the diameter of the pore be reduced to the diameter of an atom of the compound gas, or thereabouts, the oxygen finding little or no resistance, would glide through, and the nitrogen be retained. A perfect decomposition happening. This shows the importance in all investigations relative to the Endosmosis, or transit of bodies through pores, to bear in mind, that when those pores have a certain diameter, the results of experiments made on them are illusive; not representing alone the nature and value of the force exerted by the walls of the pore, but showing effects depending also, on the cohesion and other properties of the passing body.

4. These observations apply to those experiments which have been made to illustrate the phenomena of endosmosis by forcing gases through plugs of stucco, which are systems of capillary tubes of large size. Experiments on charcoal, plaster, &c., are also open to the same strictures. Had these only been resorted to, not the simplest phenomena of endosmosis could have been revealed. The disturbance of hydrostatic level, which is so well shown by a sheet of gum elastic, or an animal membrane, cannot be produced by the use of plugs, with large pores or systems of capillary tubes.

5. It might at first be expected, that as the diameter of a pore decreased, its indisposition to admit a foreign body, would increase, but it is not so—that foreign atom does not insinuate itself in a passive manner; nor does it go through the pore, merely because it meets with no resistance. There is an active and very energetic force in play, a force that is even greater, than the cohesion of the parts of the pore itself. Hence, under like circumstances, the smallness of such a pore is no bar to its receiving and transmitting foreign atoms, but very often in an experimental point of view is the most favourable condition, under which we can study its action without any retarding or complex causes.

6. There are some experimental illustrations of the fact, that closeness of texture is no hindrance to the passage of suitable bodies. I took a narrow glass pipe, about an eight of an inch in diameter, and dipping an end of it into melted gum lac, expanded thereon a bubble of that substance, by blowing at the other extremity. In this way, after a few trials, it may be made so thin as to be translucent. Such a bubble, with air from the lungs in its interior, being exposed to an atmosphere of ammoniacal gas, allows a free passage to it. A singular change in the appearance of the thin membranous bag takes place during the experiment, from being brown in the thicker parts and whitish in those that are more translucent, it becomes of one uniform flesh colour. Now, in this state, it may be regarded as one of the most

impervious of all resinous bodies, and certainly of them all it has the closest texture, yet after it has thus been exposed for a short time to ammonia, we find on passing into its interior a little reddened litmus water, that the gas is present in large quantity, and must of course have been transmitted, along the pores in the resin.

7. On the top of a tube which contained atmospheric air, and a piece of litmus paper, tinged red by the fumes of muriatic acid, I fastened very carefully a piece of gold leaf, two tenths of an inch in diameter, with gum water, and suffered it to dry. The gold leaf, when examined with a lens by transmitted light, appeared all over of an uniform pea green colour, nor could any hole or flaw be perceived in it. It was covered with a jar of ammonia, on the mercurial trough ; the level of the mercury, on the inside and outside, being regulated. The gas went through the gold leaf rapidly, and in a very short time the test paper became uniformly blue. On using carbonic acid, or sulphuretted hydrogen, the action was very nearly as instantaneous.

8. I split, with a lancet, a thin plate of Siberian mica, which for the most part appeared of a flame colour, but in places where it was unequally thick, a blue or a red. This lamina, when substituted for gold leaf in the last experiment, suffered ammonia to pass through it. A similar plate of sulphate of lime, from Sheerness, England, suffered half a cubic inch of carbonic acid to pass through it in forty minutes. Atmospheric air in all these cases was on the other side.

9. These permeations, which we have noticed to take place so rapidly under favourable circumstances, occur likewise more slowly in nature. A sea shell, for instance, deposited in that formation called London clay, in course of time loses its coagulated albumen, then its carbonate of lime, and its other ingredients, simultaneously or successively. These are replaced by the sulphuret of iron, by alumina, oxide of iron, &c., which form together a mass of so close a texture, that it can give sparks by collision. Under such circumstances as those which occur along the coast of the island of Shepply, a thin plate of carbonate of lime is permeated readily by bisulphuret of iron, so that there is a continued deposition and accumulation of that substance, in the interior of a thin shell. Hence the production of that immense quantity of fossil shells, which is there used for the purpose of manufacturing copperas for commerce. Slow motions of the same kind occur, when alloys are buried under the ground, or placed in exposed situations, a silver Roman coin has thus been known to part with much of its copper, which formed a species of crystalization on its surface, the *patina* of antiquarians. It is in this way, that trinkets of gold, on which small quantities of mercury have fallen, gradually recover their original brilliance and purity. A number of facts of this kind, showing that even in the most solid of metallic textures, motions may take place, might be referred to: these have been well considered by Boyle, in his tract on the languid motions of bodies.

10. Caoutchouc, or gum elastic, is the substance which of all others has furnished the most unexceptionable results, on studying the phenomena of endosmosis. It however at times exerts a synthetic action, which so far as I know, has not yet been noticed. Having capped an open tube, with a thin piece of this substance, and thrown into it 200 measures of hydrogen gas, it was exposed to an atmosphere of 100 measures of oxygen, contained in a wider tube, into which it was raised. In eleven days the level in both tubes was considerably raised, and the barrier which was at first of a blackish co-

lour, became quite white. In sixteen days, the united volume of both gases was only 215 measures, this on analysis contained only 14 per cent. of oxygen. It may here be stated, that a like mixture of 100 of oxygen, and 200 of hydrogen, enclosed together in a tube by the side of the former, had undergone little or no diminution. Now a rough calculation shows, that about one thirteenth of the united volume of the gases had been condensed by the membrane into water, the remaining 62.35 parts of oxygen having combined, after some chemical manner with the substance of the caoutchouc, in the process of bleaching it.

11. This result points out the condensing effect of a membrane, which often, in many arrangements, will have no small influence. Thus in Dr. Mitchell's experiment, where two bent tubes are screwed together, with a piece of gum elastic between them, the one tube containing oxygen, and the other a double volume of hydrogen, we should be led to expect, from the common theory of endosmosis, that however much the levels in the two tubes might vary, relatively to each other, the united volume of the gases ought to remain constant. If the level in the hydrogen tube rose an inch, ought not the level in the oxygen tube to sink an inch? But an appeal to experiment shows, that such is by no means the fact; to a certain extent, the volume of gas in the tubes is constantly diminishing, it is not due to leakage into the free atmosphere, between the membrane and the glass, that presses it, at least not entirely so, a part of the gases is condensed by the direct action of the barrier, to form water, and the remainder unites chemically with it. In some instances the action is still more obvious. If a vessel of atmospheric air, the mouth of which is covered by a piece of india rubber, be immersed in an atmosphere of deutoxide of nitrogen, it will not be found that red fumes will appear in the vessel, nor any other obvious indication of the presence of the deutoxide then, but the membrane soon begins to change its colour, and from being diaphanous becomes of a dirty umber brown, the volumes of the gases on both sides of it diminishing.

12. Into a tube which was covered with India rubber, and exposed to the free atmosphere, I placed 100 measures of atmospheric air, and 42 of hydrogen gas, as it stood on the shelf of the pneumatic trough, being anxious to see if any passage of the gases would ensue, as the oxygen and hydrogen in the mixture, were in nearly a due proportion to form water. Motion at once began, the level of the water in the tube rising for several hours. In the course of a few days, only a trace of hydrogen was discoverable, the remaining gas differing very slightly from atmospheric air. The same was repeated with a tube closed by a serous membrane, kept continually moistened, when all motion appeared at an end, analysis showed that there was only $\frac{1}{10}$ of the whole volume of hydrogen beneath the membrane.

13. These experiments which were repeated again and again, with the same results, establish an important doctrine. If a gas be confined beneath a system of pores, the other extremity of which communicates with another gas, movement will ensue, until the constitution of the gas on both sides of the system is alike. If oxygen and hydrogen be thus placed, they will mutually pass to each other, nor will that motion cease, until the resulting compound, on both sides of the membrane, is the same chemically. This endeavour to an equalization of constitution, takes place under all circumstances, it may perhaps be partially arrested by the condensing action of the barrier. (11.) There are therefore two prominent conditions under which the phenomena of endosmosis may be regarded: 1st. During the state of motion. 2nd. After an equilibrium is obtained.

14. Aided by this principle, we can explain how mixtures of gases would comport themselves, when exposed to free atmospheres, or when shut up in close chambers. The arrangements of (12) will serve as an illustration, here we have a mixture of atmospheric air and hydrogen, exposed to the free atmosphere. It is evident, that in pursuance of an attempt to gain an equilibrium, a portion of air from the atmosphere should pass inwards through the membrane, and a portion of hydrogen pass out. But as soon as the hydrogen is beyond the outside of the membrane, it is dissipated by aerial currents, or otherwise diffused in the mass of the atmosphere, the condition of equilibrium being in no wise approached to, for so fast as the hydrogen escapes, it is carried off; there being continually hydrogen and atmospheric air on one side of the membrane, and only atmospheric air on the other. Equilibrium, therefore, can only be gained by the entire dissipation of the hydrogen into the free air, and accordingly experiment indicates, that when that equilibrium is gained, the hydrogen has vanished, and atmospheric air is found on both sides of the membrane. But very different would that action be, if the arrangements were included in a close chamber, as beneath a small glass bell; here, when the hydrogen comes out through the membrane, it does not escape, but continually accumulates, and motion ceases, and equilibrium is gained when the relative proportion of the gases outside the membrane, is the same as inside. Hydrogen, therefore, in this case is found on both sides of the barrier.

15. Before proceeding to give an account of the chemical changes, that may happen in virtue of the action of capillary forces, it is necessary to remark, that all the analyses of gaseous mixtures in which oxygen is an element, have been uniformly made by means of binoxide of nitrogen. Living in a climate where no dependance can be placed on the action of an electrical machine, and not possessing Dr. Hare's galvano-ignition apparatus, I was led by necessity to choose between spongy platina, and the binoxide of nitrogen. After an experience of some extent in the employment of this gas, it has not appeared to deceive me,—it is indeed an eligible method in gaseous analysis, where oxygen is concerned. The mode of manipulation is as follows: with the sliding rod eudiometer, throw 100 measures of the gas under trial, above the surface of water, that has been duly exposed to the atmosphere, and contained in an inverted bell, rather wide in proportion to its depth; one made of the belly of a glass retort, or a cupping glass, answers very well. Then add 100 measures of the binoxide of nitrogen, if the gas is suspected to be poor in oxygen, but 200 or more, if the gas is richer, always observing to have the binoxide in excess. After the lapse of a minute the absorption is complete; measure the residue, and one fourth of the diminution gives the volume of oxygen, this method is analogous to that of Gay Lussac. Some idea of its correctness may be formed from the circumstance, that of 73 analyses of the air, the mean result of the amount of oxygen is 20.58 per cent. My measuring rod divides each volume into decimals by a vernier arrangement; but for most purposes of analysis this is unnecessary.

16. It results from the observations which have been made on caoutchouc, by Dr. Mitchell, that oxygen passes with much more facility through it, than nitrogen gas. Atmospheric air is also reputed to be a mixture, and not a chemical compound; it was therefore an object to try, whether pure oxygen might not be obtained by forcing air through such a membrane. Filtering or in fact straining it through a gum elastic bag. A thin piece of this substance, was therefore tied tightly over a tube an inch in diameter, and six

inches long, the tube was then filled with mercury, in such a manner that the great weight might not burst the caoutchouc, it was then inverted, and exposed to the atmosphere. The membrane bulged into the tube, in a deep hemispherical form, in about an hour its under surface was studded with bubbles of gas, and in the course of time, several cubic inches passed. This, on analysis, by means of binoxide of nitrogen, was found not to differ sensibly from atmospheric air. A similar result was also obtained, when a thin serous membrane, a piece of peritoneum stripped from the liver, was substituted for the gum elastic. No indications whatever could be obtained, that atmospheric air was decomposed, during the process. Nor is it difficult to understand and explain how this happens, when a foreign force, equivalent to a pressure of six inches of mercury, is brought to bear so advantageously on the action of a very thin membrane, for in the case of the gum elastic, the thickness could not be estimated at more than $\frac{1}{300}$ of an inch, and the serous membrane was so porous, that it could not sustain so heavy a pressure, without immediate leakage; the united gas whatever it may be, is at once forced through, the barrier being unable to stop it. A case of the same kind is met with, when porous charcoal is used, pressure forces a gas through it entirely unchanged, but if the effects of that pressure be avoided, chemical decompositions may ensue of a decisive character, as we shall shortly have occasion to see. To obtain these chemical effects, it is necessary that the barrier should not only have no pores of sensible size, but that no adventitious or foreign forces, be brought to act on the passing gas; in proportion as these conditions are fulfilled, the success of the experiment is more perfect, and thus as we shall proceed to point out, it is possible to strain the nitrogen out of atmospheric air, and procure by that means oxygen of greater or less purity.

(TO BE CONTINUED.)

Historical Note on the Discovery of the non-conducting power of Ice. By A. D. Bache, Prof. of Nat. Philos. and Chem., Univ. Penn.

In the fourth series of his electrical researches, Mr. Faraday devotes himself to the establishment of a "new law of electric conduction." In the course of experiments for this purpose, he says that he "was suddenly stopped by finding that ice was a non-conductor of electricity, and that, as soon as a thin film of it was interposed in the circuit of a very powerful [voltaic] battery, the transmission of electricity was prevented." This observation is made to lead to a beautiful train of research on the conducting powers of various oxides, salts, chlorides, &c., capable of existing in both the solid and liquid states. In these experiments, a galvanic battery of two troughs, containing twenty pairs of four inch plates, was used.

Similar results were obtained with electricity from the machine. A thickness of five-sixteenths of an inch of ice scarcely allowed the electricity to pass at all, though of this high tension.

It seems, then, that Mr. Faraday thought it necessary to investigate this fact, which he had accidentally observed in relation to galvanic electricity, in its application to electricity as evolved from the machine.

That ice is a non-conductor of electricity, thus evolved, was, however, well known to Doctor Franklin, and his associates; and whatever merit attaches to this discovery, which was considered a curious one, belongs to him, or to them.

In one of a series of letters to Mr. Peter Collinson, of London, dated in

1747 and 1748, in which he gives an account of experiments made by himself, Kinnersley, Hopkinson, and others, Doctor Franklin has the following remark: "A dry cake of ice, or an icicle held between two in a circle, likewise prevents the shock, which we would not expect, as water conducts it so perfectly well."

Again, in a paper on the aurora borealis, read before the Royal Academy of Sciences of Paris, in April, 1779, and entitled, "Suppositions and Conjectures towards forming an Hypothesis for the Explanation of the Aurora Borealis," the basis of his theory is this same want of conducting power. He says: "Water, though naturally a good conductor, will not conduct well when frozen into ice by a common degree of cold—not at all when the cold is extreme."

"The great cake of ice that eternally covers those [the polar] regions, may be too hard frozen to permit the electricity" "to enter the earth." "It may, therefore, be accumulated upon that ice."

Dr. Watson had previously affirmed ice to be a conductor; and, subsequently, Bergman and others were of the same opinion, doubtless from their not attending to the "dryness" of the ice. Bergman found reason to change his opinion, and Achard, Erman, and others, have confirmed the accuracy of Franklin's statement. These authorities have caused ice, at a low temperature, to be ranked among electrics, in the elementary works devoted to the subject.

As far as the passage from the solid to the liquid state is concerned, our electricians seem to have been better informed than the following sentence from the paper of Prof. Faraday, before referred to, supposes.

"This assumption (he says) of conducting power by bodies as soon as they pass from the solid to the liquid state, offers a new and extraordinary character, the existence of which, as far as I know, has not before been suspected."*

It is true that this remark applies particularly to galvanic electricity, but as Mr. Faraday repeated many of his results with the machine, to prove them to be coincident with the others, he obviously does not intend to limit his remarks. "All these effects," he says, "produced by using the common machine, and the voltaic battery, agree, therefore, with each other."† Again, "The conducting power of these bodies, when fluid, is very great."‡

In a letter to Cadwallader Colden, of New York, dated Philadelphia, April 23d, 1752, Dr. Franklin says, "I do not remember any experiment by which it appeared that highly rectified spirit will not conduct; perhaps you have made such. This I know, that wax, rosin, brimstone, and even glass, commonly reputed electrics *per se*, will, when in a fluid state, conduct pretty well. Glass will do it when only red hot."

He again states the same fact in the paper on the aurora, before referred to, thus: "A certain quantity of heat will make some bodies good conductors, that will not otherwise conduct."

"Thus, wax rendered fluid, and glass softened by heat, will both of them conduct."

"And water, though naturally a good conductor, will not conduct well when frozen into ice."

In these effects, our electricians saw only the general effect of heat on the conducting power of bodies, while Mr. Faraday ranks the effects observed by him in quite a different class, and founds upon them the general law that decomposition is necessary to conduction.

---

* Prof. Faraday's experimental researches in Electricity. Fourth series. Art. 412, Royal Soc. Trans., 1833.

† Ibid., art. 431.

‡ Ibid., art. 430.

Philadelphia, January, 1836.

Abstract of a paper on the Naïades, &c. By Isaac Lea, Esq., Mem. Am. Phil. Soc., &c. &c.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—By direction of the American Philosophical Society, I send you an abstract of a paper on the Naïades, &c., the last part of which was read at the recent meeting of the society, February 5th, 1836. This continuation contained descriptions of the following new species.

Unio Zeiglerianus,
“ Medellinus,
“ notatus,
“ Mühfeldianus,
“ Tampicoensis,
“ Carbonarius,
“ Vanuxemensis,

Unio simus,
“ glaber,
“ gibber,
“ Cumberlandianus,
“ pumilis,
“ Jayensis,
“ folliculatus,

Unio Hopetonensis.
“ Roanokensis.
“ lugubris,
“ creperus,
“ Lecontianus,
“ Barnesianus.

Anodonta cylindracea,
“ Wardiana,
“ salmonia,
“ Buchanensis,

Margaritana Holstonia,
“ fabula,
“ deltoidea.

In the previous parts of Mr. Lea's paper, descriptions of the following new species were read to the society.

Symphynota Bengalensis.

Unio obscurus,
“ Vaughanianus,
“ arctior,
“ pulcher,

Unio solidus,
“ coccineus,
“ Hydianus,
“ turgidus,

Unio porrectus,
“ jejenus,
“ venustus,
“ interruptus,

Unio lamellatus.

Anodonta ovata,
“ gigantea,
Ampullaria Pealiana,
Melania inflata,

Physa aurea,
Paludina hyalina,
Melania plicata,
Paludina pallida.

Also, a new and interesting land shell, sent from Brazil, by Dr. Ruschenberger, for which Mr. Lea considered it necessary to form a new genus, which he calls *Megaspira;* the donor's name is given as the specific one,—Megaspira Ruschenbergiana. Yours, &c. A. D. Bache,

One of the Secretaries Am. Philos. Soc.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Review of a "Geological Report of an Examination, made in 1834, *of the Elevated Country between the Missouri and Red rivers. By G. W. Featherstonhaugh, U. S. Geologist. Published by order of both Houses of Congress. Washington: Printed by Gales & Seaton.* 1835."

(CONTINUED FROM p. 117)

Mr. Featherstonhaugh gives a pleasing description of the Hot Springs; it differs however in some respects from the account given of them in Mr.

James' History of Col. Long's first expedition to the Rocky Mountains, for Mr. J. states that the substance deposited from them is a siliceo-calcareous matter, which Mr. F. calls a travertin, or pure carbonate of lime; it would I think seem probable, that in a country where the silicifying process is so abundantly manifest, thermal waters, such as those of the Washita Springs, would contain silex; the difference however in these accounts is of little importance. Our author in speaking of the Washita oilstone, describes it as a silicious mineral, which he calls a novaculite; in this he differs from the generality of mineralogists who consider this latter mineral as a species of the argillite; whether therefore the Washita oilstone is a silicious stone to which the name of novaculite is improperly applied; or whether being a novaculite, he is mistaken in ascribing to it a silicious character remains to be determined. On leaving the Washita Springs, he continued his route to the Caddo river, and from thence to the Little Missouri, and mentions, that in the vicinity of the latter stream, he met with a "singularly black waxy soil of a carbonaceous colour;" as, independently of the singularity of its *colour* there is something unusual in such a texture of soil, it might be wished, that he had analyzed it, and given us some more particular account of its peculiarities. He next enters the Prairie country, and we are led to expect some interesting information on the subject of their geological character and origin, from his expressions of "sincere pleasure" at "finding himself upon geological grounds, with which he was well acquainted," (p. 74). His remarks on their geological formation are however very concise, being in a great measure confined to the observation, that he found the fossil shells in the Prairies identical with those of the New-Jersey green-sand formations: and as, in another place, he describes this latter formation as subcretaceous, by which I understand him to mean secondary; he must be considered as implying, that the prairies themselves are to be classed amongst the secondary formations; other geologists who have examined them have generally agreed in placing them amongst the tertiary,—a circumstance with which he must have been acquainted:—we may therefore, without pretending to determine which of these opinions is the most correct. be permitted to express surprise, that he should have omitted to state the reasons, which induced him to differ from the general opinion. He cannot, I think, be highly complimented on the success of his attempts to solve the much disputed question of the origin of the prairies. He states (p. 77) that he is "not of the opinion of those who think that all prairies have originally been produced by firing the timber annually, and thus, by repeated combustions, destroying the timber as well as the sprouts," but I believe no one acquainted with the prairies, or with the general condition of the country when inhabited by the Aborigines, ever entertained such an opinion, for had such a cause operated to produce the destruction of the forests, we see no reason why all the lands belonging to the Indians, with whom this practice was universal, should not have been converted into prairies. It is surely unphilosophical to admit that a cause insufficient in itself to produce a given effect, can, as he supposes, become sufficient, merely because no other apparent cause can be assigned for its production. We must therefore conclude, that no prairie has originated from these annual firings. Agreeing with him thus in a great measure, that prairies have not been thus formed, we may proceed to examine his notions of the actual cause of their production. He enumerates (p. 77) "amongst the efficient causes of a prairie" that "where the vegetable matter is thin, and the season unfavourable, plants are liable to perish; and where they would not perish altogether, it must be remembered that this country was stocked with buffalo, which would by their periodical occupation of the country, assist in exterminating plants of a vigorless constitution.'' This is a strange method of accounting for the production of a vegetable growth, perhaps the most vigorous and exuberant of any in the world. But he has "another view of the subject," which he introduces by a postulate, "that the vast prairies of the west, as well as the diminutive ones in question, must be admitted to be the ancient floors of the ocean;"—as it is known to every one, who is acquainted with the first rudiments of geology, that the secondary and tertiary formations are generally believed not only to have been all covered by an ocean, but actually formed beneath its waters, he will find no difficulty in gaining assent to this position. But let us see to what purpose he applies it, when he goes on to say, (p. 77) that "when it abandoned them, they were, of course, without plants; and unless we admit their spontaneous growth, we must suppose them to have germinated from seeds derived from plants growing on lands, which had been left with a higher level than the ocean, before it receded from these prairies. Their borders would, of course, be planted first, and thus we can conceive of every new generation of plants giving some of its seeds to the winds and the waters, and gradually extending the forests, like the present members of the human family, advancing upon and settling the country for the uses of posterity."

Even if we admit that nature extends the vegetable creation over newly formed lands by this slow and gradual process, which is altogether contrary to our experience, we do not find his argument much to the present purpose; for he seems to have abandoned the prairies altogether, and to have applied his reasoning, if such it can be called, to the formation of the *forest* only, and as this is all the information he affords us on the origin of prairies, he cannot be said to have added much to the stock of knowledge on the subject.

Mr. F. mentions, on the authority of a gentleman acquainted with the country, that "plants," I suppose he means trees, "are encroaching on the prairies generally;"—this is an universal belief, indeed it is notorious, that in Kentucky, where they formerly covered a great extent of country, they are now nearly obliterated. He assigns as a reason for this diminution of their extent, the disappearance of the buffalo from the settlements of man; for he has observed, he says, (p. 76) that plants "encroach on the sides where vegetable matter has been washed and accumulated, finding a nutritious bed there, into which they can push their innumerable delicate fibres, secured from the devastating teeth and hoofs of the buffalo, which have now all left this part of the country." I do not see that his argument is, under any circumstances, very conclusive: but neither herds of buffalo, or any other wild cattle, when they roam in unrestrained freedom over the vast extent of the prairies in this country, or the pampas and llanos of South America, ever remain long enough in one place to produce any permanent effect whatever, on any part of the vegetation. The most satisfactory reason I have seen adduced for the diminution or obliteration of prairie land, is, that as the population of the country increases, new settlers generally establish their residence on the borders of a prairie, and their domestic cattle, being accustomed to be folded and fed at night, usually pasture in that part of the prairie adjoining their homes, they by these means keep down the growth of the grass so effectually, that when other parts of the prairie are burnt, on these places there is not sufficient herbage to afford fuel for the flame, and consequently they escape the action of the fire; and as the continued trampling of the cattle, on such spots, checks the luxuriant vegetation of the grass, the seeds of forest trees, which are profusely scattered over them, are enabled to germinate and throw up their shoots without danger of being choked in their infancy by the superior vigour of the prairie grass, as happens to them in those other parts, where this latter plant, reigns uncontrolled master of the plain.

Having thus followed our Geologist through his tour, we may now examine what benefits are likely to be derived from it, either to the general cause of science, or the particular interests of the country; and that he may not complain of injustice, I will give the words in which he himself (p. 91) "enumerates its most interesting results."

The first is, "the establishment of the fact, from personal observation, of there being, in the state of Missouri and the territory of Arkansas, an amount of the ores of lead and iron of an excellent quality, not only more than adequate to any estimate of the domestic consumption of this nation, but such as may justify the expectation that it will form an important element hereafter of commercial exportation from that part of the world."

Now as the fact of the existence of these mines has long been known and never doubted, he cannot be said to have established it; nor has he furnished any data by which the quantity or quality of their produce may be estimated; it is therefore difficult to discover the advantage likely to result from any thing he has said on this subject, for his observations on it are neither calculated to charm by their novelty, or to excite interest by their scientific accuracy.

Secondly and lastly, he says, (p. 94) "I consider it also as a result of great importance, that the extensive investigations which I have so recently made, have gone, without exception, to strengthen the opinion I submitted to the Geological Society of London in 1828, as to the series of rocks in the United States, being the natural equivalents of that observed in Europe, from whence we may infer that the causes which operated to bring the rocks there into the particular order of superposition they preserve, have operated here, and probably have acted upon the whole crust of the earth."

Mr. Featherstonhaugh may himself be gratified by any fancied corroboration of formerly expressed opinions; but we have no evidence in the report itself, that this result, which he deems of so much importance, has been attained; and even if it had, it would seem to have been altogether foreign to the object of his mission.

It is very apparent that throughout his tour, he has been continually torturing his imagination with the attempt to identify the rocks of this country with European formations, which he seems to consider as the types to which all others are to be referred; and he has directed his efforts to establish this theory, rather than to study the true character and give a correct description of our own rocks. That the primary rocks of all parts of the world have a great similarity of mineralogical character, and that their geological position exhibits less variety, than that of later formations will be readily acknowledged; for they have undoubtedly all originated from the same cause, and as might have been expected, identity of cause has produced similarity of effect: that those rocks, likewise, which are frequently termed "Transition rocks" differ but little from each other in the different hemispheres, is perhaps equally true. But as we ascend in the series, it is evident from the very mode of their formation, that the secondary and tertiary rocks, in regions distant from each other, have each taken their character from local and independent circumstances which have destroyed that identity of mineralogical and organic character, and that perfect uniformity in order of position, which he wishes to claim for them.

Probably in no two primary ranges do the rocks of which they are composed, occur in exactly the same proportion, and even those rocks, particularly the granites, are subject to a variation in the qualities and relative quantities of their constituent minerals. The strata, therefore, which are formed by their disintegration are likely to assume a difference of mineralogical character, and no exact resemblance is to be expected, except in those of the same family, by which I would be understood to mean, those which originate from the same primary range; and the more distant any two correspondent strata in different families are from the parent rock, the greater is the dissimilarity between them likely to become. It is most probable, likewise, that each of these primary ranges was elevated above the level of the waters at different periods of time, consequently the formation of the subordinate strata in different families could not be synchronous, and from this cause, as well as from difference of climate, and zoological station, the fossil remains of organized beings found in them, may also be expected to exhibit dissimilarity; it becomes, therefore, difficult to establish any system of equivalency between strata differing in so many particulars. When, in the same family of rocks, two are found, not immediately contiguous, but occupying similar places in the series, and, though differing in mineralogical character, identified by a similarity of their organic remains, they may, I conceive, be called equivalents, as having been deposited during the same period, and such I apprehend to be the sense in which that term is used by European writers. But when it is employed, as it is by Mr. F. throughout his report, to express a relation between strata in this country and those in Europe, it is productive of confusion and error, and, till the true nature and character of the formations of this continent are better understood, can lead to no satisfactory result. He has no where told us, what he understands by it himself, and he uses it in such a desultory way, that it is difficult to collect his meaning, if indeed he have any. For instance, (p. 59) he speaks of finding in Arkansas, a red sand, stone resting upon grauwacke slate, and says he satisfied himself "that he was upon the true equivalent of the old red sand-stone and grauwacke of English geologists;" now such a formation as that which he found may be identical in its mineralogical characters with the sandstone and grauwacke of England, but I do not see how he can call them equivalents. Again he says, (p. 41) "when we add to the list the lignites, and the equivalent quadrupedal and saurian remains found in both countries," and (p. 76) "I have found the greatest profusion of the fossil equivalents of the genera peculiar to the green-sands of Europe." If these last named fossils were *peculiar* to the green-sands of Europe, we may wonder how they got into Alabama; and, in general, we may enquire, how, under such circumstances, any fossil remains can be said to be equivalent to each other; for if they vary in character or species, there would seem to be no relation between them, and if they are of the same species they are alike or identical. In the same way, he refers on two or three occasions, to Mr. Lyell's Eocene period; as when he says, (p. 39) he "found it in various parts of the territory of Arkansas," and again, (p. 62) speaking of a deposit of marine shells, he designates it in a note, to be "of the Eocene period of Mr. Lyell." The very lucid and beautiful arrangement proposed by Mr. L. for determining the relative ages of the different tertiary deposits, will doubtless greatly facilitate the study of them in all parts of the world, and remove much of the ambiguity which has hitherto attended the line of demarcation between them, and the secondary strata; and as Mr. Conrad has observed, "although the tertiary formations in this country do not exactly correspond with those of Europe, there can be no objection to use their terms to designate them, as they apply equally well here as there." It requires, however, a perfect knowledge of fossil conchology, and an intimate acquaintance with the molluscous animals now inhabiting the waters and land of this vast territory, together with great patience of investigation, to enable any one to make a correct application of this system. Now, I would not be supposed to insinuate a doubt of Mr. F.'s conchological knowledge, but, as he made so brief and cursory a visit to the country he is describing, he must be aware that some incredulity may be felt as to the correctness of these off-hand assertions; an explanation of the reasons which led him to such conclusion, would, therefore, have been more satisfactory to men of science, and more instructive to a great portion of the "all," to whose intelligence he professes a desire to make his report *transparent.*

I would likewise suggest, that his geological phraseology is somewhat loose and indeterminate; for instance, he makes repeated use of the term "carboniferous," as applied to limestone, and as, in the commencement of his work, he professes to follow the improved Wernerian classification, which separates the strata into primary, transition, secondary, and tertiary classes, and in which we find no mention of a carboniferous group, some explanation of the term, if he chose to employ it, would seem to have been desirable; for unless defined by the adoption of the classification of Philips or Delabeche, it is singularly inappropriate, since, strictly speaking, all limestone is carboniferous. The use of the word "subcretaceous" is still more objectionable, particularly in a country where chalk is altogether wanting; indeed, I do not know from whence he has taken it; Delabeche uses the term "supercretaceous," to express the tertiary formations, but "subcretaceous" is not found in his system, and it does not appear whether Mr. F. himself intends to apply it to all the secondary formations, which interpretation it would certainly bear, or only to the green-sand formation of the Atlantic States.

The truth of his theory, respecting the greater antiquity of this continent, when compared with that of Europe, as deduced from the absence of some of the secondary strata found in that section of the globe, must be considered as questionable, till it is proved that the tertiary are actually incumbent on the primary or transition rocks, which, I believe, has not yet been, in any case, ascertained; for if they are not, they must rest on the secondary, and the only conclusion to be drawn, from the greater proportional part of the surface they occupy in this country, would be, that at the period of their formation, a great portion of the secondary rocks had not been raised above the waters of the ocean.

With regard to his pertinacious adherence to the dogma of European geologists, relative to the invariableness of the "constant succession in the order of rocks, in respect to their superposition to each other," (p. 42) I would only remark, that a study of the transition rocks between Baltimore and Cumberland, and of the coal districts and secondary rocks of the valley of the Ohio. would, in my opinion, convert the most staunch believer in such a doctrine, from so erroneous a faith.

His suggestion of giving the more determinate name of "Atlantic Primary Chain" to the range of mountains which traverses this part of the western continent, is worthy of notice, for certainly much confusion and misunderstanding prevail from the names now so indiscriminately given to its different parts. His advice to the governments of the different states, to use caution in the selection of the persons to whom they entrust geological surveys, is likewise judicious, of which perhaps, no more convincing proof is requisite, than the perusal of this report.

Authors are said to feel a parental affection for the fruits of their literary or scientific labours, and the parental στοεγη is frequently stronger in proportion to the weakness or deformity of the offspring. Mr. Featherstonhaugh may, therefore, think I have treated his bantling with undue severity; but, as every citizen of this country is interested in vindicating its literary and scientific, as well as its political character, I cannot refrain from the remark, that if a work, such as this, can be presented to the National Legislature of the American people, and by it be ordered to be printed, and thus circulated with the stamp of its approbation through the world; if it is extolled with the most adulatory encomiums by a great portion of the newspaper press, and receives no castigation in the pages of those journals, whose peculiar province it is to be leaders and guides in matters of science, it is time for America to abandon all pretensions to rivalry with Europe on such subjects, and sink at once into that station of mental inferiority, which has been sometimes so contemptuously and so unjustly assigned to her, by a certain class of transatlantic writers. P.

Franklin Institute.

Annual Meeting.

The annual meeting of the Institute was held at their Hall, on Thursday evening, January 21st, 1836.

Thomas Fletcher, Vice President, in the Chair;

J. Henry Bulkley, Rec. Sec. P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books were received from Messrs. J. Henry Bulkley, Henry Troth, Edward H. Gill, Christopher Wesener, Carey, Lea, & Blanchard, James Harper, Abraham Miller, C. B. Trego, and William Maclure, of Philadelphia; Edward P. Roberts, of Baltimore, Md.; and the Mechanics' Institute, of Manchester, England.

Major Hartman Bache presented a chart of Charleston harbour.

Mr. L. V. Badger, of Portsmouth, N. H., presented a model of a hot air forge.

Specimens of minerals and ores were received from Messrs. Thomas Pearson, John C. Trautwine, Captain J. J. Wheeler, Samuel V. Merrick, Samuel Tyson, Edward H. Gill, and John C. Cresson.

The Corresponding Secretary laid on the tables the periodicals received during the past quarter, in exchange for the Journal of the Institute.

Isaac Hays, M. D., from the Board of Managers, read their twelfth annual report, which was accepted, and referred, for publication, to the Committee on Publications.

The Treasurer presented his report for the last quarter, which was read and accepted.

Prof. A. D. Bache, from the Committee on Science and the Arts, presented a report of the transactions of the Committee for the past year, which was read, and, on motion, was accepted, and referred to the Committee on Publications.

Mr. John Horton, from the Committee of Tellers appointed to receive the votes of the members for officers and managers of the Institute, for the ensuing year, presented their report of the result of the election; when the Vice President declared the following gentlemen duly elected.

James Ronaldson, President.

Isaiah Lukens,
Thomas Fletcher, } Vice Presidents

John C. Trautwine, Rec. Sec.
Isaac Hays, M. D., Corr. Sec.
Frederick Fraley, Treasurer.

Managers.

Samuel V. Merrick,
Abraham Miller,
William H. Keating,
Isaac B. Garrigues,
Rufus Tyler,
John Struthers,
Matthias W. Baldwin,
Mordecai D. Lewis,
Benjamin Reeves,
Alex. Dallas Bache,
Alexander Ferguson,
J. Henry Bulkley,
Joshua G. Harker,
John Wiegand,
John Agnew,
Wm. B. Reed,
Alexander M'Clurg,
Joseph S. Walter, Jr.,
Samuel Hufty,
John C. Cresson,
*James M. Linnard,
*Andrew M. Eastwick,
*Isaac P. Morris,
*Earl Shinn.

Prof. A. D. Bache, Chairman of the Committee on the Explosions of Steam Boilers, presented Part I of the report of the Committee, being the report of the experiments on the explosions of steam boilers, which, after reading the preface, was accepted.

Extract from the minutes.

Thomas Fletcher, *Vice President.*

J. Henry Bulkley, *Rec. Sec. P. T.*

Twelfth Annual Report of the Board of Managers of the Franklin Institute.

The Board of Managers, in surrendering to their constituents the powers with which they have been entrusted, have, as their last official act, the duty to perform, of laying before the society an account of its proceedings during the past year.

The great object for which the Institute was founded,—"the promotion of the mechanic arts,"—has been pursued with unabated zeal and assiduity. By means of lectures, schools, collections of models and minerals, a library, and a journal, information of the most valuable description has been disseminated to mechanics, and emulation among them excited, by premiums for the best productions of their workshops.

The Department of Instruction consists of a regular course of lectures on Chemistry, applied to the arts; one on Natural Philosophy, and occasional lectures on other sciences; a drawing school, and a school for elementary instruction of apprentices. The lectures are, as usual, well attended; they are especially devoted to the instruction of mechanics in such branches of science as are of practical application in the exercise of their trades, and the advantages derived from them are strongly felt, and generally acknowledged.

---

* New members.

The drawing school, under the charge of Mr. William Mason, and Mr. John Maclure, is at present in the most prosperous condition. The number of students admitted this year was so large, (sixty-seven,) that the room formerly appropriated to the school was found too small, and more ample accommodations have been furnished.

The collections of models and minerals, though still small, are highly useful for reference, and their future enlargement should be an object of constant and strenuous exertion.

The library continues to increase, and already embraces 1500 volumes. Of these, 199 have been added during the past year; 48 volumes by donation, 81 by exchange for the Journal, and 70 volumes by purchase.

The Journal of the Institute continues to grow in public favour, though its circulation has not yet become so extensive as its merits ought to obtain for it. The extension, however, recently sanctioned by the Board, which will contribute much to its utility, will also, no doubt, obtain an increased patronage. By the extension alluded to, mechanics will be furnished with more of the elementary matter they have desired than heretofore, while those who are devoted to scientific pursuits, will receive a full account of the progress of science here and abroad. To enable the Editor and Committee on Publications to accomplish this, the size of the Journal page is enlarged, so that one-sixth more matter will be furnished to the subscribers, and this without any increased cost to them. The Institute, it is hoped, will be remunerated for additional expense, by the increase of patronage which this arrangement will obtain.

The Committee on Science and the Arts have continued their useful labours during the year, with unabated zeal. On this committee are to be found individuals of the various callings embraced in the arts, and inventors who submit subjects to them are sure of a thorough, practical, and scientific investigation. The award of the Scott's legacy premiums and medals being made by the managers on the recommendation of this committee, improvements in the arts submitted, are rewarded, when of standard merit, by this testimonial, in addition to a published report. For the details of the transactions of this committee, the Board refer to the report of the Chairman.

The report of the Committee of Premiums and Exhibitions, will furnish you the details of the exhibition of domestic manufactures, held in October last. It is sufficient here to state, that the display was in all respects gratifying, and creditable to the skill of our artisans.

The Committee on the Explosions of Steam Boilers have completed the most important part of the experiments, instituted at the request of the Secretary of the Treasury of the United States, and have drawn up a report of the same, which the Board has ordered to be transmitted to the Department, and a copy of which will be laid before the society this evening.

The Board have, on the part of the Institute, paid the first instalment of $15,000 to the masonic company; but this company not having been prepared to deliver up the premises, purchased by the Institute, at the period originally agreed upon, an arrangement has been made by which they are to retain possession until the 1st of March next, and allow to the Institute interest for the first instalment paid; and the payment of the second instalment, which was to have been made on the 1st instant, is postponed until possession of the property is given. An arrangement, under existing circumstances, advantageous to the Institute.

Two hundred and seventy-three members have been elected during the past year, sixty have resigned, and sixteen died; the number of members at present is 1921.

The funds of the Institute, as will be perceived by the Treasurer's report, which is annexed, are in a prosperous condition. The receipts for the past year were $9.960 26, and, after honourably and promptly meeting all claims, as made, there remains in the treasury, $3,065.13. The sinking fund amounts to $12,013 43.

The Board cannot close their report without congratulating the society upon their prosperous situation. The success which has hitherto attended their efforts, evinces the judiciousness with which they have been directed, and affords a stimulus for continued and increased exertions for the advancement of the great objects for which we have been associated.

Isaac Hays, *Chairman.*

William Hamilton, *Actuary.*

Annual Report of the Transactions of the Committee on Science and the Arts.

In pursuance of the directions of the Committee on Science and the Arts, I beg leave respectfully to present to the Institute, a report of the transactions of the Committee for the past year.

The Committee have examined, by sub-committees, during the past year, thirty-four subjects, or inventions, submitted to them, besides ten which were continued over from the preceding year. Of these, nineteen received favorable reports; six were judged worthy of the award of the Scott's legacy medal and premium; and three were withdrawn by those who presented them for examination, or the sub-committees discharged.

The premiums awarded from the Scott's legacy fund, during the past year, present a favorable view of the progress of some branches of practical science, which have hitherto not received contributions from our countrymen. Such was the award to Amasa Holcomb, of Southwick, Mass., for a method of mounting reflecting telescopes, combining the greatest simplicity with stability. To N. Bassett, of Wilmington, Del., for a compass for detecting and measuring local attraction. To W. A. Burt, of Michigan, for an ingenious apparatus for measuring the variation of the needle, to be used with the common compass, and remarkable for the facility with which it furnishes approximate results.

To Mr. Holcomb belongs the merit of having succeeded in making and polishing a speculum of eight inches aperture, which, when mounted in a front view telescope, gave highly satisfactory results. Double stars, 1.4″ and even 1.2″ apart, were divided by the telescope.

The mechanical inventions which received the award of a premium, were a shifting gauge cock, by Mr. Philos Tyler, of Philadelphia, and a knitting machine, by Messrs. M'Mullin and Hollins, of Sinking Valley, Pennsylvania. The former is a substitute for the common gauge cocks, the office of which it completely fulfils; it is simple in its construction, and very convenient. The knitting machine is necessarily complex, but performs its work very perfectly, and is well guarded against derangement.

The tinned lead pipes of Mr. Ewbank, which have received a similar award, will prove particularly valuable for water pipes, in situations where lead is corroded by the water passing through it. They are offered at a cost very little exceeding that of the ordinary lead pipes.

Although the rules in regard to the award of these premiums are handed to every inventor, who submits an invention to this Committee, and are published in the Journal of the Franklin Institute, some of the awards are yet imperfect, from the omission to present drawings, or models, of the inventions, as required by those rules.

Following out the principle to publish their reports, when the inventions submitted are brought before the public by patents, or otherwise, or when the publication is desired by the inventor, there have been published in the Journal of the Institute, during the past year, nineteen reports. There yet remain unpublished, but which have been ordered for publication, ten reports.

These proceedings show that the activity manifested by the Committee during the first year of its organization, has continued unabated during that just completed. The confidence of inventors in the counsel which it furnishes to them, seems, also, to have been undiminished. Thus, the design of the Franklin Institute, in the constitution of the Committee, is fully carried into effect.

The Committee have to regret the decease of one of their young and promising fellow members, Mr. J. Wilson Mitchell, deceased August 21st, 1835.

The number of the Committee is, at present, sixty-eight.

A. D. Bache, *Chairman.*

January, 1836.

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1835.

With Remarks and Exemplifications by the Editor.

1. For a *Machine for Spreading a Solution of India Rubber upon Cloth;* William Atkinson, Lowell, Middlesex county, Massachusetts, August 15. (See specification.)

2. For a *Saw Set;* Theodore Taylor, Port Deposit, Cecil county, Maryland, August 15.

The setting with this instrument is not to be performed by a blow, as is usually done, but by the action of a lever, the long and short arms of which stand in a direction nearly vertical, there being two bends in it, at right angles, near its lower end, where the fulcrum is placed. Its lower termination is in a triangular face, adapted to the form of the tooth of the saw, which tooth is pressed between it and a suitable anvil, or bed piece, furnished with adjustments, to adapt it to different saws.

"Now, what I claim as new, and as my invention, is the angular lever by which the force requisite to set the teeth of the saw is applied to the triangular foot; the strap, with the thumb screw and stops; also, the form of the rest, operating in the manner, and for the purposes, herein set forth. I do not claim the bevilled anvil, and foot for setting saws, but only in combination with the parts above claimed."

We have not seen this saw-set in operation, but, so far as the evidence before us justifies an opinion, we think it likely to answer better than most of those which have been previously patented.

3. For a *Churn;* Joseph Turner, Poland, Cumberland county, Maine, August 15.

This churn has a formidable array of levers, rods, and connecting joints, by which two dashers are to be worked up and down in an oblong square box; we do not think it worth the space which would be required to describe it, or to furnish the claim; the former would show a complex mode of effecting that which has been repeatedly, and as well, done by more simple means; and the latter a variety of mistakes in supposing old things to be new.

4. For a *Machine for Shelling Corn;* Joseph Turner, Poland, Cumberland county, Maine, August 15.

A vertical wheel, set with pins upon its face, is to be made to revolve, and the shelling is to be effected between this wheel, and a follower borne up towards it by spiral springs. There is nothing in the particular arrangement of the follower, as claimed by the patentee, to render it better than the analogous contrivances which have been used in the machines with vertical wheels of cast-iron. The claim is to "the follower, as made in three distinct pieces, and the application of the spiral springs to the follower, together with the slide separating the cob from the corn." This latter claim, so far as we can understand it, is for a thing without any novelty; but as it is not represented in the drawing, and the latter has no written references whatever upon it, a little obscurity may be expected.

5. For a machine for *Dipping and Cutting Candle Wick;* William Morey, Charleston, Worcester county, Massachusetts, August 15.

We cannot pretend to describe the construction or action of this machine. as neither the specification nor the drawing furnish the means for doing so, We do not believe that a whole college of competent workmen would be able, with their united intelligence, to construct the apparatus from the description which these supply.

6. For a *Cartouch Box;* Robert Dingee, city of New York, August 15.

The flap of this cartouch box is to be fastened to the body by means of a long metallic hinge, instead of depending upon the leather covering alone, which, by exposure to the weather, is said to become very hard, difficult to open, and easily broken.

7. For a machine for *Hulling Grass Seeds;* Samuel Gould, Jr., New Portland, Somerset county, Maine, August 15.

This machine is to rub the seed between a cylinder and two hollow segments, all covered with perforated sheet iron. The cylinder is not to turn round, but to vibrate backwards and forwards, each of the hollow segments embracing a quadrant, or more, of its lower half. The segments stand at a sufficient distance at the upper edges, to feed the machine. The description is not full, and there is no claim.

---

8. For a *Cooking Stove;* Solomon Dixon, Richmond, Wayne county, Indiana, August 15.

This stove is intended for wood, or coal; we do not see any thing in it entitling it to special notice, although we do not know of any other in precisely the same shape, or having exactly similar shifting, or moving, parts.

"The improvements which are new, and for which I claim a patent, are the slides, the valve, with the cuts, or openings, in the diagonal plate, and the passage for the heat and smoke caused by the cuts, and in the vacuum below, in the semicircular box."

---

9. For a vertical *Cutting and Press Machine for Books and Paper;* Benjamin Morris, Oxford, Chenango county, New York, August 15.

The cutting part of this machine is very similar to that of those in general use, in which a long knife is brought down vertically to cut the edges of books, or paper. The following may give some idea of the points of novelty claimed by the patentee.

"I have thus shown the construction of my vertical cutting and press machine in all its principal parts, and, in so doing, have described many things which I do not claim as of my invention; but what I do claim is, first, the attaching the knife by which the cutting is to be effected, to a separate frame, as shown in the drawing, which separate frame, with the knife, may be removed from the sliding frame, and again affixed thereto by means of thumb screws and buttons, for the purpose of sharpening the knife, without altering the setting or adjustment thereof. I claim, secondly, the general combination and arrangement of the different parts of this machine, as described, for the purpose of moving the frame of the cutting knife, and also of the frame for pressing; not intending, however, by this claim, to confine myself to the precise arrangement which I have exhibited, but to vary this as I may think proper, whilst I attain the same end by means substantially similar.

---

10. For a *Machine for Splitting Shoe Pegs;* Mark Wilder, Peterborough, Hillsborough county, New Hampshire, August 15.

A vertical frame has, at its lower end, a cutting knife for cutting the pegs, which knife is attached to a vertical slide, that is operated upon by a toggle joint, worked by a bar, or pitman, in the usual way. The blocks, after having been pointed by a grooving tool, are placed upon a sliding bed below the knife, where they are secured upon a metallic disk adapted to receive them. The sliding bed is made to advance by the action of a feed rod, which receives its motion from that of the toggle joint, and slide. The grooved block must, of course, be adjusted to the knife, and must also be surrounded by a strap, to keep the rived parts together.

The claim is, to "the toggle joint, lever, and knife shaft, the revolving disk, and appendages, together with the palls by which the feeding is effected, the whole operating in combination for the purposes, and in the manner, herein set forth and described."

The claiming of the toggle joint, palls, &c., separately, is not a safe course, as they are not the invention of the patentee; yet, by a fair construction of the foregoing, they are claimed individually, as well as in combination.

---

11. For an improvement in Hubbard's *Rotary Pump;* David M. Walker, Cavendish, Windsor county, Vermont, August 15.

This might as well have been called an improvement upon a dozen other rotary pumps, as upon Hubbard's. Like the rotary pumps which have preceded it, it is difficult to make, and of little worth after it is made, as its operation depends upon the fitting of revolving pieces of metal to the interior of a drum, or cylinder, in which they revolve. Had the patentee been acquainted with the history of rotary pumps, as they have been known for upwards of a century, he would not have placed this upon record.

---

12. For *Making Potash;* Elijah Williams, Harbour Creek, Erie county, Pennsylvania, August 15. (See specification.)

---

13. For *Ships, constructed wholly of Iron;* Charles Olcott, Medina, Medina county, Ohio, August 15.

The only thing proposed to be changed is the material of which ships are constructed, as "no alteration is made in the *exterior shape*, or model, of vessels. The relative proportions of the hulls, masts, spars, and other parts of vessels, are to be the same, or nearly the same, in ships built on this plan, as before." In the claim, the patentee confines himself to the forms of the various individual parts, furnished with flanches, &c., for putting them together, "all exactly in the *manner* and of the *materials* above described."

The patentee states that the invention was made by him in the year 1815, although circumstances have caused him to delay the taking of a patent until the present time.

Steamboats, and various masted vessels, have, many years since, been made of iron. Masts for ships, also, have been constructed of the same material, and the question of adopting it in the building of sea vessels generally, has been a subject much discussed. Who first suggested the idea, we cannot tell, and it is likely that the thing is not known; but we are certain that it could be traced back beyond the year 1815. The mere building of ships of iron is not now, therefore, a legitimate subject for a patent, as the proposition is not new to the public. The exact construction, or form, of the individual parts, as described and claimed by Mr. Olcott, if new, is his; but this, without a claim to the system, will be of little value, and such a claim would, manifestly, be invalid.

---

14. For a *Washing Machine;* Calvin H. Farnum, Norwich, New London county, Connecticut, August 15.

A cylinder is to revolve within a box, in the manner of the common dash wheels; the periphery of this cylinder is to consist of slats set in the manner of the buckets of a water wheel, in order that they may cause the suds in the box to pass forcibly into the cylinder. The box is to be enclosed, to keep in the steam; the lid at the top is to be of zinc, brass, or copper, an the gudgeons, and other metallic parts, are also to be of one of these substances, instead of iron.

"The invention claimed, is the improvement made in the above described machine, by the use of a metallic top and lid; and the confinement and application of the steam; and the use of zinc, copper, or brass, gudgeons and boxes, and the arrangement of the floats of the wheel."

The metallic covering is injurious, defeating, by its conducting power, the very object for which it is professedly adapted; well fitted and arranged coverings and doors of wood are to be preferred. The substitution of the metals named for gudgeons and boxes, to avoid the danger from oxide of iron, is a thing well known; the form of the floats may probably be advantageous.

---

15. For a *Machine for Sawing Shingles;* David B. Moore, Gilmanton, Strafford county, New Hampshire, August 15.

In this shingle machine, the sawing is to be effected by a circular saw. The bolt, or block, from which the shingles are to be sawed, is confined on a carriage by proper hold-fasts. A shifting motion is described, by which the thick and the thin ends of the shingle are alternated. Many of the parts are much like those used in other shingle machines, and the claims, therefore, are limited to the particular modes of construction devised and described by the patentee.

---

16. For a *Machine for Making Bricks;* George W. Gilbert, Pittsburgh, Allegheny county, Pennsylvania, August 15.

The machine here patented is accompanied by a drawing, sufficiently well executed, so far as it goes; and it might probably be found sufficient for its purpose, if the specification were such as to fulfil its share of the business of description; this, however, is altogether defective, containing little more than a mere catalogue of the respective parts. It ends with a claim to "the arrangement and adaptation of the several parts of the before described machine for making bricks, particularly the wheel of moulds, the pistons, guides, pin, and lever, and the spiral cam for moving the wheel of moulds."

The *wheel of moulds*, which is *particularly* claimed, is not new, and the individual things enumerated may be important as making parts of a combination, but, taken by themselves, they are trifling, and not fit subjects of a claim.

---

17. For *Bricks for Fire Proof Roofs;* James Parker, Gardiner, Kennebec county, Maine, August 15.

These bricks are rhomboidal at their ends, so that when their flat sides are placed horizontally, their edges will have the same inclination with the intended roof. This comprises all the information necessary respecting their shape. To form a roof they are to be laid on laths, or on smooth boards, as may be preferred, when they will present a smooth and even surface. The claim is to "the peculiar form of the bricks, and of the mould in which they are to be made; and the application of bricks to the purpose, in the manner described."

Without animadverting upon the claim, we will observe that the use of tiles is objectionable on account of their great weight, which renders it necessary to frame the roof, and to build the walls with corresponding strength. How it may be with the houses in Maine we know not, but in most parts of the union the roofs and walls would not sustain the load which it is here proposed to put upon them, and to enable them to do so would cost more than metal roofs, which are incontestibly superior in all respects to those of brick.

18. For a *Press for Cotton, Hay. &c.;* Ebenezer Macomber, and Laban S. Macomber, Gardiner, Kennebec county, Maine, August 15.

This press is peculiar in the mode in which it is acted upon, which is by levers applied by hand to teeth on a vertical piston, or shaft, on the top of which is the follower. The main lever used for the purpose must correspond in length and in stoutness, to the power with which it is to act. Upon the bottom, or platform, of the press there are boxes of cast-iron which have ridges upon them serving as fulcra to sustain the lever; these fulcra are movable, so that the power applied may vary with the resistance. The distance gained by raising the piston is retained by wedges which slide forward by the action of a weight, passing over a pulley. The whole appears to be skilfully arranged, and we have been informed that in packing cotton it has performed considerably more work with the same power than any of the presses known in the neighbourhood of the place where it was erected; an effect which appears to be due, principally, to the little friction to which it is subjected.

We do not give the claims, as they refer not only to the general arrangement, but also to certain particular parts which we cannot take time to describe.

---

19. For *Machinery to facilitate Evaporation;* John Goulding, of Boston, and Reuben Brackett, of Lynn, Massachusetts, August 15.

This patent is obtained for "machinery for facilitating the evaporation of solvents, or fluids, and in various water proof compositions or mixtures, from the cloth or other substance to which said mixtures or compositions may be applied, and also for condensing the same again, or converting them from an aeriform into a liquid state."

The cloth coated with a solution of India rubber is to be wound upon a roll in such a manner as to allow it to form a spiral with a space between each coil. The reel and the cloth so wound on it is then to be enclosed in a box, or case, of wood or of metal, fitting together so perfectly as to prevent the entrance or the escape of air. From the top of this case, or box, there is a tube leading to a condensing apparatus of any convenient form. Heated air, or steam, is to be admitted into the case, either through the axis of the reel, if made hollow for that purpose, or through any other convenient opening, the effect of which will be to evaporate the volatile solvent. The claim is to the accomplishing this object, and to the collecting of the solvents by the means described.

---

20. For a *Stove for heating Tailors' and Hatters' Irons;* John Lewis, Derby, New Haven county, Connecticut, August 17.

A cast-iron furnace is to be made to contain anthracite, and under this there is to be an ash pit. Around the furnace, or "chamber of combustion, are placed several linings of sheet-iron, about an inch apart, forming air-tight chambers enclosing columns of *fixed air* (?) to prevent the lateral escape of the heat." There is to be a cover to the stove, which is to be an "air-tight chamber formed by several linings of sheet-iron or tin, enclosing columns of *fixed air*, to prevent the escape of the heat into the room." The claim is to "the application of fixed air chambers around a stove for the purpose of heating tailors' and hatters' irons; at the same time preventing the heated air being trausmitted into the apartment in which the stove is placed in the manner before described.

By *fixed air*, we suppose is meant air fixed within the chambers. The apparatus itself, we apprehend, will be more costly than a small brick furnace built for the purpose, without being more convenient.

---

21. For the application of *Water Lime Cement to the Construction of Roads;* Joseph Roby, Jr., Albany, New York, August 27.

The whole system contained in this specification is that so well known of forming roads by the employment of hydraulic lime with beds of gravel, or broken stones of a suitable quality; the directions given do not contain any thing with which engineers are not familiar, and the patentee tells us, in conclusion, that "he would add to his specification and claim, the right to construct roads, streets, &c., by the use of water lime or cement, in any other manner than above described," a right which will be very readily conceeded to him, provided it be not an exclusive one; to this both the ancients and the moderns may well demur. Our shelves would furnish a volume of evidence of the antiquity of such roads; we have opened the "*Dictionnaire Technologique*" only at the article "Cement," and give the following note: "I have very recently had occasion to examine a piece of natural hydraulic lime, from which a hydraulic mortar of great excellence is prepared, and which is principally employed in the construction of cement pavements of very great solidity."

---

22. For a *Churn;* Caleb Angerine, City of New York, August 17.

Mr. Angerine obtained a patent for a churn some time ago, and although he has a new patent he has not a new churn, as this last is a fac simile of such as were previously on the shelves of the patent office. Two churns of the ordinary kind are placed upon a platform, the two dashers are attached to a vibrating beam, to which motion is communicated by a crank, aided by a fly wheel. The patentee claims "the application of the *walking beam*, *fly wheel*, *pendulous lever*, *operating crank and pitman*, in giving motion to one or more churns at once.

---

23. For a *Harpoon;* Dexter N. Chamberlain, Boston, Massachusetts, August 17.

The patentee says, "What I claim as my invention is the introduction of prussic or hydrocyanic acid into a harpoon, for the purpose of destroying whales or other fish, or animals usually taken by that instrument, and furthermore I claim the construction of a harpoon as I have herein above described."

We do not dispute the fact of the patentee being the inventor of the use of prussic acid for the purpose designated, but if he was, he has been unfortunately dilatory in applying for a patent, as two or three years have elapsed since we were in correspondence with other individuals upon the same subject, and the taking of a patent was then declined because it was found that the idea was not new. The public papers have noticed it, long since, and it can scarcely, therefore, be called *new*, at the present day.

---

24. For a *Wire Door Spring;* John Codman, Boston, Massachusetts, August 17.

The spring is called "the vertical tortine, wire door spring," and a patent was obtained for it on the 10th of December, 1832. The regulating box and wheel described in the former patent have been improved, and this forms the subject of the present application; a semicircular groove is to be made in the box and wheel, the object of which we cannot take time and space to describe.

---

25. For the *Application of the Waste Heat from Forges, Furnaces, &c.;* Tunis Leroy, Newport, Herkimer county, New York, August 17.

A steam boiler is to be so placed as to receive a due portion of the waste heat of forges, furnaces, &c., by which means a power is to be obtained which is applicable to various useful purposes. The doing this is the thing claimed. Owing to the great increase in the number of patents, we do not so frequently as formerly, turn to day and date to show when, and how often, patentees have been anticipated in their inventions. Our own patent office, and the establishments in foreign countries, might both be appealed to in proof that the foregoing possesses no claim whatever to novelty.

---

26. For an improvement in *Power, and other, Looms;* Amasa Stone, of Rhode Island, but now residing in England, August 17.

In the specification of this patent particular reference is made to one formerly obtained by Mr. Stone, and dated the 13th of April, 1829, and upon which the present plan is to be considered as an improvement. After explaining the construction of his apparatus, by reference to drawings, the patentee says that, "having now described my improvement in power looms, and other looms for weaving silk, linen, cotton, woollen, and other cloths, called a taking up motion, together with the arrangement of parts by which the same may be carried into effect, I do hereby declare that I consider my claim of improvement or invention to consist in and extend to the connection of the reel with the cloth beam (in those looms where my former improvement already referred to is applied) and in the communication of motion from one to the other, and in the regulation of the motion of the cloth beam by the motion of the reed, by whatever combination of machinery, apparatus, or gearing, the same may be effected."

The object in view, and the general means of attaining it, appear to be similar to those of Mr. Burr, in the patent numbered 31, for the last month, (July.)

---

27. For *Gates for Canal Locks;* David Wilkinson, Cohoes, Albany county, New York, August 17.

There is a good general drawing of the apparatus patented, but the description and claim lend little or no aid in making known the views of the patentee. The latter is as follows:

"The invention claimed consists in the before described mode of adjusting the friction roller, for the quadrant, or circular rail ways; the rider to guide the chain on the capstan; the open head with palls of the capstan, and the self-adjusting valve gate."

---

28. For *Winding Silk from the Cocoons, without Reeling;* Gamaliel Gay, Poughkeepsie, Dutchess county, New York, August 17.

The particular construction of this machine is shown in a drawing which accompanies, and is referred to in, the specification. The claim is to "the winding of silk from the cocoons directly on to the spools, without the intermediate process of reeling; and also to that arrangement of the winding machinery by which the same is, or may be, effected, acting substantially as set forth."

29. For a *Mowing Machine;* John P. Chandler, Wilton, Kennebec county, Maine, August 17.

The frame work of this machine runs upon four wheels, three of which turn freely on their axles in the usual way, but one of the hind wheels is employed to give motion to the mowing apparatus, by means of a wheel and band. The scythes, four in number, are attached to the periphery of a wheel which revolves horizontally below the body of the carriage. In this specification there is nothing in the form of a claim; the general principle is not new, nor does the arrangement of the parts of the machine offer any thing to bespeak a more favourable opinion of its operation than of that of several others of the kind which have had a brief existence, and then passed into oblivion.

---

30. For a *Spiral Band Wheel;* Samuel S. Walley, Charlestown township, Chester county, Pennsylvania, August 17.

The title of this patent led us to suppose that a band twisted spirally was to be employed upon a wheel; but as in books, so in patents, the title and the contents have sometimes but little connexion with each other. The patentee has conceived a notion that he can obtain a great increase of power by passing a band over polygonal or angular wheels; and we have a notion that if he ever attempts to use a band in the manner described by him, his example will not have a single follower. A description of the affair is out of the question; we must omit that and pass to the claim, which is to "the above described combination and structure of machinery applied so as to produce an increased power or effect from the increased adhesion of the band by its coiling one or more times upon an angular conical cylinder, or wheel, adapted for the purpose as aforesaid; and by the employment of a square hole with rollers, as a means of transmitting the band, and communicating circular motion from a perpendicular to a horizontal wheel, and vice versa, without the intervention of intermediate wheels as aforesaid."

If the reader does not understand the whole from the foregoing, it would be of little use to present the entire specification and drawing, as these would involve him in inextricable darkness.

---

31. For a *Machine for Breaking Anthracite Coal;* Jonathan S. Hubbell, city of New York, August 17.

This is a machine to effect that which we are very apprehensive must continue to be done by hand. The coal is put into a kind of trough, the bottom of which is formed of iron bars, or grating; and hammers, or beaters, are made to rise by a revolving shaft, and to strike upon it. It is proposed to place an inclined screen below the trough to divide the coal, and we believe that this will be a very useful appendage, as we have no doubt that a large portion of it will be well pulverized, and that the remainder will be very unequally broken.

---

32. For *Grinding and Chopping Grain;* Pierson Cope, Washington township, Fayette county, Pennsylvania, August 17.

This is merely a mill with a conical nut and box, the axis of which is placed horizontally, the feeding being effected through an opening in the shell at the small end. The claim is to "the plan of the castings; the plan of the furrows that they may grind fast with little power, and discharge freely through the opposite end, and the plan of tempering screws with the iron slides, and putting it together for convenience;" each of which plans has about an equal claim to novelty.

---

33. For a *Pocket Pistol;* Victor M. Wallace, West Topham, Orange county, Virginia, August 17.

The object of this invention is "to give the greatest length possible to the barrel of the pistol, for the purpose of discharging the ball with increased velocity and greater precision in its direction, as well as to a greater distance." To effect this object the back end of the barrel is cylindrical, and is passed into the stock, reaching to its end, the part grasped by the hand descending nearly at right angles from the upper portion. The percussion cap passes on to a nipple at the centre behind the barrel, the trigger operating upon it through the intermedium of a main spring and other appendages, contained within the handle of the stock.

The claim "is not to the discharge from the centre of the breech-pin, but simply to the manner of construction described, namely, the rounded back part of the barrel, with the manner in which I insert the breech pin, for the purpose of drawing the shoulders of both towards each other; also the disposition of the lock, as contained in the lower part of the grasp of the stock, also the interior of the trigger, and its adjustment as described."

There is some sacrifice made by rounding the back part of the barrel, as the breech is thereby rendered smaller than the outer, or muzzle, end; perhaps, however, means may be found to remedy this defect.

---

34. For a *Cooking Stove;* Ezekial Gore, Jr., Guilford, Windham county, Vermont, August 17.

Here is a rectangular box which is divided into three compartments; the two end ones are ovens with doors, the middle contains the furnace, the upper end of which extends through the top of the box, where it is fed with fuel, and through which passes a tube leading into two boilers which stand on either end of the box, above the ovens. We do not think it worth while to give the claims as the thing is old in nearly every part; it is not long since a patent was granted for a stove nearly identical with this even in its minutia.

---

35. For the *Application of the rising and falling of the tide to the propelling of Machinery;* Henry B. Fernald, Portsmouth, Cumberland county, Maine, August 17.

"A buoy of sufficient strength and dimensions, connected by a rope or chain passing from the buoy under a pully at the bottom of the water, with a wheel which moves the machinery. In the falling of the tide, or water, the weight of the buoy, filled with water by means of a stop cock, or otherwise, operates as a propelling power, being so connected by another rope or chain to another wheel, as to operate alternately with the wheel above-mentioned."

"What I specifically claim as my invention or discovery is the principle of applying the rising and falling of the tide, and other water, to the propelling machinery."

At p. 154, vol. 5, there is the specification of a patent granted on the 23d of December, 1829, to Henry M. Webster for a "tide power," in which it is said that "the object which the subscriber proposes to effect is to bring into value and use the rise and fall of the tide on the seaboard, and particularly in the principal cities of the Union, to be employed in manufacturing and other purposes."

The two plans, it will be seen, are identical; in the first patent it is proposed to use "vessels or floats of great weight and buoyancy," "a condemned or other hulk of a ship of required size," being mentioned as suitable for the purpose. Some remarks of the editor will be found appended to the specification alluded to.

---

36. For a *Lady's Saddle Tree;* John M. Bouton, Newark, New Jersey, August 17.

All the information given in the specification is that there is to be "a safety guard or rail extending from the head of the cantle, made from steel, iron, wood, or any other material, and secured at the two ends to the saddle tree by loops, sockets, rivets, nails or screws. The safety guard runs from the head to the cantle in a circular form, and is especially useful in securing the seat of the rider, and making them sit firmer and more safe."

Although this specification appears to be the work of a gentleman of the law, its requirements have been either misunderstood or overlooked, as the foregoing, most certainly does not distinguish the invention from all other things before known or used, nor set it forth in those full clear and exact terms which will enable a competent workman to make the thing intended to be described.

---

37. For a mode of *Fitting the boxes for gudgeons into the plummer blocks; and also the bearing of the slides for Locomotive and other Steam Engines, and for other purposes;* Matthias W. Baldwin, city of Philadelphia, August 17. (See Specification.)

38. For *Preparing of the Oil of Harze*; Christopher Preswick, and John M. Fisher, city of New York.

"The object of our invention is to prepare an essential oil from the condensible matter, or overflow, which is obtained in the manufacture of carburetted hydrogen gas, from resin-wood. or bituminous coal, or a mixture of them, and the said oil may be applied to the following purposes; that is to say, in the preparation of paints, varnishes and laquers, also as a solvent caoutchouc (or gum elastic); also for furnishing light in lamps." The condensible matter is to be mixed with animal or vegetable charcoal, and then submitted to distillation, the volatile oil being condensed. The claim made is to the effecting this object, in the manner proposed.

The tar, or condensible matter collected in making carburetted hydrogen from pit-coal is regularly submitted to distillation in England, and the essential oil, a species of naphtha, obtained from it is employed in dissolving caoutchouc, and for other purposes; yet this, according to the terms of the foregoing patent, appears to be one of the objects which the patentees claim as their own invention.

---

32. For a *Machine for Sowing Plaster, Lime and Ashes;* Julius Notch, Great Bend, Susquehanna county, Pennsylvania, August 17.

A long trough, or box, divided into separate compartments, resembling so many small hoppers placed in a line with each other, is to be mounted on wheels, and to be drawn forward in the manner of a cart. The sides of these troughlike hoppers are inclined towards each other as they approach the bottom, where they are only an inch or two apart; a rod extends from end to end of the opening, and partially closes it. The material to be scattered is put into the trough, or hoppers, and a longitudinal, vibrating motion is communicated to the above named rod, which has teeth, or pins, on it, to agitate the plaster, &c., and cause it to be scattered. The machine is badly described, and the claims made confine the patentee to the particular mode represented of effecting his object; they are to "the arrangement and adaptation of the crank, crank-rod, elbow, and horizontal rod, arm, and sliding rod, with its teeth, together with the regulating gauges, as described." It would require but little mechanical skill to construct a machine to answer all the purposes of the foregoing parts without using either of them "as described."

---

40. For an improvement in the art of *Making Brushes;* Wm. Steel, city of New York, Aug. 17.

The stocks are to be prepared as usual for set, or drawn, work, and the setting, or drawing, is to be effected in the usual way; the difference between them and other brushes consisting in the substitution of feathers for bristles. The feathers are sometimes to be used by doubling them in the middle, so that the quill, as well as the feather end may project out; the quill end, if desired, may be split, or divided into several ends. In other cases the quill ends are to be inserted within the stock. "This applicant claiming the exclusive right to the mode of constructing brushes of feathers, for the following uses, viz: for dusting brushes of all kinds, hearth brushes, water brushes, and hair brushes of all kinds. This applicant contemplating the application of the principle of this improvement to the construction of all kinds of brushes which may be made of feathers instead of bristles."

The title of this patent is incorrect, as the improvement is not in the *art* of making brushes, but in the employment of a new material; it is therefore, properly, a new manufacture.

---

41. For an improvement in the *Screw Wrench;* Solyman Merrick, Springfield, Hampden county, Massachusetts, August 17.

In this screw wrench the sliding jaw is not drawn back by turning the handle, as is usually the case with those imported, but the bar which is at the back, and makes a part of the sliding jaw, is acted upon by a nut which swivels in it, and turns upon a double threaded screw, extending from the oblong square part upon which the sliding jaw moves, to the handle, which is of wood. The nut is made octagonal, and is easily turned by the thumb and finger. The claim is limited to the arrangement of the screw and nut, which we believe to be new.

These articles are manufactured by N. Foot & Co., Springfield, Massachusetts; we have seen them, and can aver that in point of construction and of workmanship, one of them is worth several of the best imported wrenches.

---

42. For a *Vapour Bath;* Pierre Paul Nöel D'Alvigny, city of New York. An alien, who has resided two years in the United States; August 17.

We have here a long story about the construction and use of this vapour bath, after perusing which, we are no wiser than we were before we commenced the task, the whole system adopted, being such as is well known, both in this country, and in Europe. The patentee claims "the manner in which he has combined and arranged the several parts described," which, with the exception of such variations as would be made by any two persons forming a similar establishment, presents, as we have said, nothing new.

---

43. For an improvement in the *Saw Mill Saw;* Levi Fisk, Schroon, Essex county, New York, August 17.

Every third tooth of a saw mill saw is to be sharpened to a cutting edge on its upper side, the teeth so sharpened being alternately on reverse sides of the saw; these teeth are then to be so set as to cause them to take a thin shaving off in their ascent, and thus to plane the sawed stuff, or to render it much smoother than is done by the common saw. It is said that experience has shown that the best effect is produced by so sharpening every third tooth, although an adherence to this number is not absolutely necessary. The claim is, to "the *upper oblique* edge of saw teeth being cut to the right and left alternately, and set together, or betwixt any number of common teeth, for the *upward* motion of the saw, for the purpose of sawing wood in a smooth manner, as above described."

---

44. For a *Churn;* Clifton C. Stearns, Bucksport, Hancock county, Maine, August 17.

This churn is to have a vertical shaft, to which a revolving motion may be given, by means of a winch and bevil gearing. The dashers which project from the shaft, are to stand at an angle of about 45° with it, which, it is said, will give a tendency to the butter, as it is formed, to accumulate about the centre, thereby improving it, and causing the churn to work with the greater ease. The claim is to "the plan, or principle, of giving the dashers an oblique position, by which the butter, when formed, is thrown or accumulated in the centre of the churn."

---

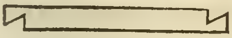
45. For a *Pendulum Level;* Asahel Munger, Oberlin, Lorain county, Ohio, August 17.

"This improvement consists, principally and especially, in attaching a tube, or a straight bar, with a sight at each end, to the top of a pendulum, in such a manner as to admit of its being arranged or adjusted, either by screws, or otherwise, at right angles with the pendulum, and may be suspended within an enclosure of any kind, which shall protect it from the influence of currents of air."

We have been in the habit of supposing that those persons who use levels, sometimes read books on the subject of surveying, engineering, &c.; but we find that this must not always be assumed. The pendulum level has been mentioned and exhibited in a thousand books, in all the languages of civilized nations. It is to be seen, with the pendulum enclosed, in *Leupold's Theatrum Machinarum*, in plate 3, vol. iii., published in 1724; how long it had been then known, we have not taken the trouble to ascertain. Its merits, or rather its demerits, have been a matter of frequent discussion.

---

46. For a machine for *Planing and Matching Boards;* Fisher Stedman, Acquackanockin, Essex county, New Jersey, August 17.

The specification of this patent is equally laboured and obscure, yet it is manifest that the writer has desired to make it plain. It seems as though the model had been depended upon to make the machine known, as the drawing, although on three sheets of paper, can scarcely be said to illustrate any thing. Toothed wheels, revolving cutters, saws, &c., &c., are all represented by simple lines, so that the man who should attempt to make the machine, must invent it in all its details. We learn, however, after much labour, that boards are to be planed by a round horizontal cutter wheel, under one side of which they are to be passed, by the aid of pressing rollers. The matching is to be by a dovetailed joint formed by horizontal cutters, which take away half the stuff on opposite sides towards each edge, thus,  if we understand the thing correctly. The claim is to "the whole apparatus and combination of machinery by which the board is traversed by the cutters in dressing the surface, and by which the edges are matched in the dovetail form, as described above, and is the invention for which a patent is now prayed."

The first part of this claim is altogether untenable, the dressing of boards by traversing cutters, in the way described, having been practised in numerous instances. Dovetail cutters were used at the navy yard in Washington, sixteen or eighteen years ago, for matching wharf timbers, and they were not then new; still, in the combination with the other machinery, had that not been altogether old, it possibly might have been sustained.

47. For an improvement in the *Manufacturing of Chairs;* Eli F. Benjamin, Utica, Oneida county, New York, August 17.

A machine is employed for the purpose of boring the different parts of the chair which are to be connected together, as all the chairs made upon the plan of the patentee are to be put together by dowells. The machine has a shifting top, upon which the pieces to be bored are secured by proper means, the movements of the top admitting of giving the proper rake in all directions; there are, attached to the frame, two spindles, running like lathe spindles, to receive the bits to be used. The claim is to "the putting chairs together by or with dowells, and the described form of machinery for expediting every part of the work."

The model is referred to throughout the specification, which is a very gross error, though by no means an uncommon one. A drawing is given, but it does not furnish the details of the "described form of machinery;" to an ingenious workman, this, it is true, would be a thing of little consequence, as he could easily construct the required apparatus without trenching upon the claims of the patentee.

48. For a *Rarefied Air and Rotary Motion Steam Engine;* George Cameron, Washington city, August 17.

This is one of the oldest and worst species of engines ever made, as its power is to be derived from blowing the steam on to the buckets of a wheel. Much stress is laid upon the using of a forked pipe, leading to opposite sides of the wheel, and furnished with stop cocks, to reverse the motion. The rarefied air part consists of a similar wheel, on to which the rarefied air from the furnace chimney is to be directed. We would propose as a motto for this, "*de pis en pis.*"

49. For *Preparing and Hatcheling Hemp, Flax, &c.;* John Goulding, Boston, Massachusetts, August 19.

In this machine, the hemp is to be laid in a trough, in small handsful, and carried forward by a feeding apron, between feeding rollers, which deliver it on to a large hatcheling cylinder, set with suitable teeth, between which it is pressed, so as to lie closely on the cylinder, by means of a reel-like roller, the longitudinal wires of which mash between the wire teeth. After passing under this cylinder, the hemp is raised, by a contrivance for that purpose, upon a second cylinder, revolving about seventeen times more rapidly than the former, and, of course, drawing out the fibres. From this second cylinder, it passes through a trumpet-mouthed tube, between rollers, and into a can. The slivers from ten, or any other convenient number, of such cans, may afterwards be passed together through the same circuit, and this may be repeated as often as may be thought necessary.

The claim is to "the above described mode of hatcheling hemp, flax, tow, or Manilla grass, and producing thereby a continuous strand, or sliver." We think that this claim is in terms too general, unless it can be made to appear that the machine is new in all its arrangements, as applied to the purpose for which it is to be used.

---

50. For an improvement in the *Endless Chain Horse Power;* Benjamin Wales, Hallowell, Kennebec county, Maine, August 17.

The main dependence for sustaining the slats of this horse power, is the construction of the links, or hinges, by which they are connected together; various forms of the stop hinge joints, or self-supporting arches, have been devised for the same purpose, but they are all insecure, depending too much upon the strength of each individual joint. The patentee claims, "the modes of forming the hinge, and the peculiar form of the link; the forming of the end wheels with lips and projections; the mode of communicating power by the projections of the chain fitting into the indentations between the projections of the wheels; and the mode of sustaining the chain, and keeping it in its place by means of the railway and small wheels, as described." The novelty of some of these things is more than doubtful.

---

51. For *Medicine for Cholera;* Robert S. Bernard, Norfolk, Norfolk county, Virginia, August 17.

Take

Sulphate Alumine, . .	2 grains.
Sup. Carb. Potassa, . . .	1 "
Alcohol, 80° above proof, .	40 drops.
Gum. Camphor, . . .	20 grains.
Hoffman's Anodyne Elixir, .	½ oz.
Compound tinct. Opium, . .	½ oz.
Sp. Lavender, . . .	1 oz.
Pure water, ...	3 oz.

A table-spoonful of the mixture in as much water, to be taken every hour, or half hour. For children, in proportion.

This is to cure Asiatic Cholera, Cholera Morbus, and Diarrhœa.

---

52. For a *Cooking Stove;* Edward N. Kent, Portland, Cumberland county, Maine, August 17.

The patentee finds much in this stove to commend, and we have no doubt that a good dinner may be as well cooked by it, as by many others; there is not enough of novelty in it, however, to render any particular description necessary; the claims are, to "the damper for dividing the draught each way, and its rack; the *form* in which the stove is made to cook so many different ways, with less fuel and trouble than is caused in other stoves, I do not claim." Less could scarcely have been claimed, but still we believe it will be found that even this little is more than is really new; dampers, or valves, having been used in various ways, to divide the draft, and to direct it over, under, or around, an oven, much in the way described in the present instance.

53. For *Covering Houses with Sheet Tin, &c.;* Charles Bonnycastle, Charlottesville, Albemarle county, Virginia, August 17.

This patent is taken for improvements on the plan for which a patent was obtained by the same gentleman, on the 29th of June, 1833. The object aimed at is a simple and easy mode of fixing the rooffing of buildings, so as to allow a free play to the expansion and contraction for which it is subjected, both longitudinally and laterally. The particular way in which this is effected, would require a cut for its explanation.

54. For *Destroying Weevils, and other Insects, and their Eggs, in Grain; to Expel Moisture from Grain, Meal, and Manufactured Flour, and for Drying Malt;* James A. Lee, Maysville, Mason county, Kentucky, administrator of James Lee, deceased, August 17. (See specification.)

55. For a *Machine for Serving Ropes, or Rigging;* James Fales, New Bedford, Bristol county, Massachusetts, August 20.

A perpendicular frame is made capable of traveling upon rollers, and at a convenient height from the floor; upon this frame there is a cog wheel with a tubular shaft, which wheel is so made that a portion of its rim, say one-fourth, or one-third, may be removed, for the purpose of admitting and removing the rope to be served, and again firmly fixed in its place. A rack, containing a reel for the serving yarn, is placed behind the wheel and hollow axles. In using this machine, the rope, after being passed through the tube, is stretched *taut;* the yarn, by the aid of a serving mallet, is passed around the rope in the usual way, and motion being then given to the wheel, by proper gearing, the serving is expeditiously performed. The claim is to "the above described combination of machinery, and its application to the purpose of serving ropes, or rigging."

56. For an improvement in the *Grist Mill;* Adna L. Norcross, Hallowell, Kennebec county, Maine, August 20.

There may be an improvement here, but in what it consists we do not know, as the drawing, which is referred to, is a very poor affair. We learn, however, that the runner, of twelve inches in diameter, is to be fixed upon a horizontal shaft; that the bedstone, which is square, is to be grooved out to receive the runner, and that a small groove on the upper side of the bed stone is to admit the grain. The claim is "to the peculiar form and manner of constructing the mill stones, together with the general arrangement of the machinery."

57. For machinery for *Spinning Hemp and Flax*; Andrew Caldwell, Lexington, Fayette county, Kentucky, August 20.

The patentee says that, "by the machine I have invented, and the improvements upon the spindle, (which requires one hand to each spindle,) I am enabled to spin twice as much yarn as is now spun by one hand in the ordinary mode, besides having brought the operation of spinning into the compass of a room, and adapted it to a new source of labour, old and young, male and female." He does not, however, make any distinct claim, but leaves it to be inferred, from the general description, in what his invention consists. A number of figures are given in the drawings, and we cannot afford the space which without these would be required to describe the article.

58. For an improvement in the *Double Acting Forcing Pump;* William Douglass, Middletown, Middlesex county, Connecticut, August 20.

It is here stated that the valves in the common double acting forcing pump are usually covered, and hinged with leather, and that the improvement which the patentee has made in this part, consists in the employment of puppet valves, of metal, which, he says, are well known, but not hitherto employed in such pumps. The cap, and bottom, which cover and sustain the main cylinder, and the suction and discharge cylinders, are to be so cast as to adapt them to the use of such valves. The claims made are, "*First.* The application of the aforesaid metallic *toad stool valves*, in the heads of my pump, in lieu of said leather valves, or any other kind of valves now in use in double acting forcing pumps. *Second.* The construction of the end pieces, or heads, of said pump, so as to cover at once the ends of the several cylinders, and so as to admit the insertion of metallic, or any other kind of valves, in said end pieces, or heads, instead of having them placed in the pipes."

Such valves have been used in double forcing pumps, as well as in others and we do not believe, therefore, that the claim of the patentee can be sustained; and if it can, he would certainly be confined to the particular arrangement which he has adopted.

59. For *Slabs for Fire Backs, Stove Linings, &c.;* Joseph Putman, Salem, Essex county, Massachusetts, August 20.

All that we learn from this specification is, that moulds are to be made to receive the clay, which moulds must be in the form necessary to give to it the intended shape; that the clay is to be beaten in by a mallet, and the superfluous portion removed.

60. For *Constructing Granaries;* John Harmony, Chambersburg, Franklin county, Pennsylvania, August 20.

The thing here patented is very simple, and, if effectual, is of great value. The "improvement consists in introducing a hog or sheep pen, either under or very close to a suitable room, or apartment, into which the grain is to be put, having found, by repeated experiment, that the effluvia of the pen, or some such cause, operates as a complete preventative against the attacks of the weevil, and also that, should the grain be infected by them, they will speedily leave it." After this information, the patentee describes what he esteems a good plan for the erection of such an establishment; but the particular mode is not considered as important, the claim being simply to "the combination of a hog pen, or sheep pen, with a granary, as set forth."

61. For an improvement in the *Harrow and Cultivator;* Peter Clark, Aurora, Erie county, New York, August 20.

This cultivator is so constructed that its two sides, which form a V, as usual, may be expanded, or contracted; there is also some variation in the manner of forming the teeth, but the change in this part does not appear to be very definite, or important. The claim is to "the peculiar formation of the tooth, without a flanch; the mode of fastening it, and giving it a forward direction suited to the graduated width of the harrow, and to the method of graduating the same."

---

62. For an improvement in *Steam Boilers, and the method of feeding them;* Nathan Reed, Belfast, Waldo county, Maine, August 20.

The construction of this boiler, with its appendages, is very clearly described, and well represented in a good outline drawing; the things claimed, also, are distinctly set forth, leaving nothing to desire on this point.

The boiler is to be cylindrical, and is to contain within it a furnace, and a flue passing through it, in the manner of many others. The boiler is not to be placed horizontally, but is to be elevated at its back end; as shown in the drawing, this elevation is equal to one-half of its diameter. From the back end of the boiler there rises a vertical cylinder, which is to be the reservoir for steam, it being intended to keep the boiler entirely full of water, and to allow it to rise to a certain height also in the reservoir. The reservoir contains a float, which is to be sustained by the water, and from this float rises a vertical rod, passing through a stuffing box at the top of the reservoir. The apparatus by which the feeding of the boiler is to be regulated, is governed by a lever, acted upon by the rising and falling of the float rod; but the particular arrangement of the parts intended for that purpose, would require the drawing for its explanation. One peculiarity of this arrangement is, that the feeding of the boiler is to proceed when the motion of the engine is stopped; in this case, if the water is sufficiently low, a tube is opened, by the turning of a stop-cock, which admits a portion of steam from the reservoir into a case containing a small rotary engine, or steam wheel, constructed like an ordinary water wheel, which is blown round, and works the supply pump of the engine; when requisite, a portion of the steam blows off through another tube, opened at the same time with the former, as, otherwise, the velocity of the feeding engine might be too great.

The claims made are to the construction of the boiler, so that every part exposed to the action of the fire shall be kept constantly full of water, whilst the steam generated shall ascend freely into the reservoir, where it is isolated from the direct influence of the fire by a stratum of water. The manner of fixing and connecting the float, so as to ensure a more frequent action of the feeding apparatus. The method of giving vent to the accumulated steam, by the same operation which shuts off that from the engine; and the method of diminishing the velocity of the feeding engine, by the additional waste pipe.

Were it not the case that floats, rods sliding in stuffing boxes, supply pumps, and other apparatus usually combined and connected in self-regulating and self-feeding contrivances, added to steam engines and their boilers, are each liable to derangement from causes which cannot be rendered self-regulating, we should expect much from the apparatus described, which is ingeniously imagined, and looks well upon paper; but we are admonished, by some knowledge of practical results, not to trust implicitly to fair promises, and specious appearances, especially where complicated machinery, and powers of difficult management and control, are concerned.

63. For a *Brick Press;* Henry Hunsicker, and Joel Krauss, Northampton, Lehigh county, Pennsylvania, August 20.

This brick press possesses considerable originality, and is sufficiently well described. It contains two moulds, which are operated upon by the same lever, the moulds being upon a sort of railway, upon which they pass alternately under the lever. The moulds are of cast-iron, and their bottoms constitute movable pistons, which rise and deliver the brick at the top by the same movement which carries the moulds under the pressing lever. Each mould has its own follower, which rises, and closes on it, by the general shifting motion, all which is distinctly shown in the drawing. Theclaims made refer to the particular construction of the respective parts, for producing the action required.

---

64. For a *Washing Machine;* David Winthrop, Kennebec county, Maine, August 27.

Stocks, or beaters, are to be worked backward and forward in a trough, as in many other washing machines, the trifling change made in this we will not wait to describe, but merely give the claims, which are to "the application of the gear work to the stocks; and to the putting them directly through the arms of the stocks."

---

65. For a *Washing Machine;* William and John Collins, Norwich, New London county, Connecticut, August 27.

This machine is so much like that patented by Charles Otis, on the 15ht of June last (see p. 62) that we need not repeat the description.

---

66. For the *Application of Hydraulic Cement to various purposes;* Obediah Parker, city of New York; Timothy Clowes, Hempsted, New York, and Lyman Garfield, Troy, New York, August 27.

American hydraulic cement is to be employed to form *lithotaphs*, for the bodies of the dead. An oblong mould of boards is to be made which may be seven feet long, and three feet wide; this is to be placed upon the ground, and a layer of about four inches of hydraulic cement put within it. The corpse, either in a coffin, or some suitable envelope, is to be laid upon this, and the mould, which should be about two feet six inches high, filled with the cement, the mould being then removed, the *lithotaph* is finished.

Rows of these may be placed close to each other, and upon them may be deposited other *lithotaphs*, so as to form a *necropolis.*

This forming of *lithotaphs*, and a necropolis, is claimed by the patentees; and also the forming of lithotaphs in ordinary vaults, or repositories of the dead. They also claim the giving to them different forms, with inscriptions, &c.

We have so often given our opinion respecting this kind of application of what is well known, in a way obvious to every one, that we shall not repeat it here. We are, in this instance, at no little loss how to assign to each of these patentees a share in inventing a thing which has no, or very little, invention in it, yet each must have contributed his quota, and we take it for granted that each can point to his own share. (See Dayton, Hoyt, and White's patent, p. 39, and White's, No. 35, for July.)

---

67. For *Ranges for Cooking, &c.;* Thomas B. Smith, city of New York, August 27.

A series of cast-iron boxes, lined in part with fine brick, is placed within a table, or dresser, for cooking, &c; each of them is to have a grate to sustain the coals, and an ash-pan or drawer, below it; provision is made for varying the height of the grates, by placing them upon different ledges, and there is to be a flue to carry off the heated air, &c."

Claim.—"What I claim as my own invention in the foregoing range, is the combination of the whole; and its application to use in the manner described."

In a contrivance so old as ranges of such boxes for stewing, boiling, &c., &c., so very like those described, it is to be wished that the patentee had been less general in his claim, and that he had distinguished his invention "from all other things before known or used."

---

68. For *Arresting the Sparks from Locomotive Engines;* Alfred C. Jones, Portsmouth, Norfolk county, Virginia, August 27. (See description at p. 100.)

---

69. For improvements in the *process and Apparatus for Distilling Spirits of Turpentine;* Isaiah Jennings, city of New York, August 27. (See Specification.)

---

70. For an *improvement in the art of manufacturing Neck Stocks;* Thomas Goodrum, city of New York, August 27.

"The principle of this improvement consists in the manufacture of neck stocks with strips or pieces of whalebone, of any convenient size and shape, instead of bristles or hair."

The whalebone is to be split into fine shreds, and interwoven in the foundation for stocks, as hair is interwoven. The patentee tells us that "the advantage of this material, over other materials, consists in its cheapness, and in its preserving, in a superior degree, its elasticity, in not being liable to be broken down, and in its uniformity of size, being of the same size throughout, whereas bristles and hair are tapering, and larger at one end than at the other."

The validity of the patent does not depend upon the validity of each of the reasons assigned for its superiority, or we should really doubt its being sustainable.

---

71. For an improvement in the *Gearing of Mills;* Cleaverious R. Coleman, Barry's Bridge, Lunenberg county, Virginia, August 27.

A complex arrangement of wheels is here described, which presents nothing new in principle, or advantageous in practice, although the patentee proposes its application to mills of nearly all kinds. Thirteen cog wheels are represented in the drawings as employed to get up the intended motion. There are two wheels, or rims, with teeth on their interior, pointing towards the centre: these are fixed to a frame, one above the other, the main shaft, with four cog wheels on it, revolving vertically within them; two of these cog wheels mash into two others, which in their turn mash into the rims, within which they travel round.

We do not think it necessary to trace the movement any further, but will add the fashionable claim of the arrangement and adaptation of the several parts of the before described machinery for the gearing of water, wind, horse, hand, steam, saw, cotton, thrashing, and fanning mills."

72. For a *Thrashing Machine, for Rice and other grain;* William Matthews, Charleston, South Carolina, August 27.

Most of the parts of this thrashing machine are so similar to many others before used, that it would be time lost to describe them: in making out his claim, the patentee seems to be at some loss to divide the new from the old, as will appear from the following.

"What I claim as my invention is, *first*, the plan of setting the forward feeding table roller nearer to or further from the feeding rollers. *Second*. The application of the cog wheel gearing, according to the plan and proportions set forth, for driving the feeding rollers. *Third*. The application of a beating cylinder, either with stationary bars, and square, or rather oblong teeth, (or with the hinge beaters, though I do not claim the invention thereof) to a concave bed as described above; though I do not claim said form of bed as my invention. *Fourth*. The application of the comb, driven as above set forth, and over the bed above described; though I do not claim the invention of said combs or bed."

The foregoing may serve well to exemplify the absurdity of the claim so frequently made to the *application* of what belongs either to an individual, or to the public. It is the application of what a patentee himself invents, that gives to his patent its whole value.

---

73. For a *Thrashing Machine;* John Gearhart, Rush township, Northumberland county, Pennsylvania, August 27.

"What I claim as my invention, or improvement, in the machine for thrashing grain and seed, is the mode of constructing the concave beds and cylinders as above set forth. The concave bed differs from those of other thrashing machines by being *whole*, instead of being segments, and of course is more solid and true, and can be put in, or taken out of, the frame, with much greater facility. The cylinder differs from those of other thrashing machines by being *whole*, instead of being in *segments*, and of course is more solid and true."

If the patentee had seen one half of the thrashing machines which have been devised and made, the above supposed difference would have vanished from his imagination.

---

74. For a *Plough;* William Holt, Buffalo, Erie county, New York, August 27.

The mould board, share, and coulter, of the cast-iron plough, are, according to his statement, improved by the patentee; but if they are so, he has failed in pointing out his improvements with sufficient clearness. We are told that the handles and beam are to be of wood, but that the mould board must be of cast-iron, as also must the land side and the share; the latter is to have a square point for the purpose of entering the lower part of the coulter. Several other equally important matters, of a like nature, are stated, to which is added that the plough is to be "used by applying horse power to the end of the beam, and is guided by a person having hold of the handles." The specification closes with the information that his plough will perform its work in a very superior manner."

---

75. For *Fire Engines;* Thomas Odiorn, Portsmouth, Rockingham county, New Hampshire, August 27.

In this fire engine the box that is to contain the water is covered with a circular platform upon which the persons who work it are to walk; the engine being worked exactly in the manner of a ship's capstan. The head into which the levers are inserted revolves upon a hollow shaft through which the tube ascends that leads to the crane neck. There are teeth on the lower edge of this head, forming it into a crown-wheel, and these take into four pinions, having cranks on them, which work the pistons of four pumps, forcing the water into a central air vessel. The claims made embrace the particular mode of constructing and working fire engines, as above described.

76. For a *Pump applicable to Ships and other purposes;* Thomas Odiorn, Portsmouth, Rockingham county, New Hampshire, August 27.

There are to be two pumps, placed near to each other, and above these is a shaft placed horizontally, with a winch at each end, by which it is made to revolve. The pumps used are the "triangular valve pumps" invented and patented by Jacob Perkins, and described and represented in Rees' Cyclopedia. A strap, or chain, is attached to the rising valve of each of these pumps, and raises it by winding round a drum on the horizontal shaft; these drums are alternately thrown in and out of gear, so that whilst the bucket of one pump is being raised, the other descends by its gravity, and in this way a constant stream is obtained from one or the other of the pumps. The claims made are to the particular form and arrangement of the respective parts, described and figured, by which the drums are thrown in and out of gear, and the pumps alternately worked.

The description and plate of Mr. Perkin's pump will be found under the article *Pneumatics*, in Rees, and the mode of working it there shown will be found incomparably superior to that now patented, the power being more readily and advantageously applied.

77. For a *Grater;* Ebenezer B. Story, Buffalo, Erie county, New York, August 27.

This grater consists of a sheet of tin perforated with holes, and placed in a box in a sloping direction, so as to make an angle of fourteen degrees with the horizon. "The length of the box on the top is to be two feet one and one fourth inch. The length of the bottom of said box is one foot eight and one fourth inch; the width ten inches, the height thereof nine inches. The size of the grater may be varied to suit the wishes of the person for whose use it is made. I claim therefore the invention of such grater, and such improvements as herein set forth and described."

A more trifling patent than this does not often find its way to the office.

78. For *Roller Grooving Planes*; James Herman, Lancaster, Fairfield county, Ohio, August 27.

This improvement consists in placing metallic rollers on the face, and on the fences of the planes to lessen the friction; an additional bit is also to be added to each plane, for the purpose of champhering the corners of the tongue and groove. We are not sure that the rollers will be deemed an improvement by workmen generally, a certain adhesion of the plane to the stuff being generally thought advantageous. Much care also will be required, or the gudgeons of the rollers will soon wear out. Would not steel facings be better?

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—There are no occultations of stars of the sixth magnitude, and upwards, visible at Philadelphia in the month of April.

S. C. Walker.

Meteorological Observations for December, 1835.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches			Inches.	
	1	24°	35°	29.90	29.90	W.	Moderate.		Clear—lightly cloudy.
	2	21	23	30.10	30.20	NW.	Blustering.		Clear day.
	3	12	27	.40	.36	W.	Calm.		Clear—lightly cloudy.
	4	24	40	.00	29.76	SW.	Moderate.		Clear—cloudy.
☺	5	31	33	29 60	.60	W.	Blustering.		Clear—flying clouds.
	6	20	32	.54	.54	NW.	Moderate.		Lightly cloudy.
	7	20	30	.80	.85	W.	Brisk.		Clear—lightly cloudy.
	8	24	28	.94	30.00	W.	do.		Cloudy—clear.
	9	24	40	30.00	.00	SW.	Moderate.		Clear—lightly cloudy.
	10	30	31	29.95	.00	W.	Blustering.		Clear day.
	11	15	33	30.00	30	W.	Moderate.		Clear—lightly cloudy—snow in n't
☾	12	31	34	29 94	29.80	N.	Brisk.	1.05	Rainy day.
	13	32	32	.80	.77	W.	Moderate.		Clear day.
	14	28	43	.60	.53	SW.	Brisk.		Lightly cloudy.
	15	19	36	.83	.65	SW	Moderate.		Clear—lightly cloudy.
	16	8	13	.85	.95	W.	Blustering.		Clear day.
	17	5	11	30.22	30 25	W.	Moderate.		Clear—lightly cloudy.
	18	15	25	.20	.20	SE.	do.		Lightly cloudy—sleet.
	19	26	26	.06	.13	E.	Calm.	.37	Sleet—cloudy.
⊗	20	32	34	.10	.05	SE.	do.		Thaw—foggy.
	21	34	41	29.90	29.90	W.	do.	.13	Rain—cloudy.
	22	32	33	.86	.90	W.	do.		Cloudy—clear.
	23	17	25	30.15	30.25	W.	Moderate.		Clear day.
	24	17	30	.30	.30	SW.	do.		Clear—lightly cloudy.
	25	35	45	29 90	29.90	SW.	Calm.		Cloudy—lightly cloudy.
☽	26	44	47	.45	.45	S.	do.	1.25	Rain—cloudy.
	27	36	35	.50	.65	NW.	Blustering.		Flying clouds.
	28	22	39	.95	.85	SW.	Moderate.		Clear—flying clouds.
	29	26	41	.75	.70	NNE.	do.		Lightly cloudy.
	30	30	42	.60	.60	NW.	do.		Clear—lightly cloudy.
	31	33	32	.62	.75	NW.	do.		Cloudy—clear.
	Mean	24.74	32.77	29.87	29.90			2.80	

	Thermometer.	Barometer.
Maximum height during the month,	47. on 26th.	30.40 on 3d.
Minimum do.	5. on 17th.	29.45 on 26th.
Mean do.	28.75	29.88

Note.—The specifications of American patents, and several original articles, intended for this number, have been forced out, and are unavoidably postponed to the next month.

JOURNAL
OF THE
FRANKLIN INSTITUTE
Of the State of Pennsylvania,
AND
MECHANICS REGISTER;
DEVOTED TO
Mechanical & Physical Science,
CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

(*Continued from page* 164.)

VII. To determine by actual experiment whether any permanently elastic fluids are produced within a boiler, when the metal becomes intensely heated.

To make this experiment, the bottom of the boiler was to be intensely heated, water to be injected, and the elastic fluids disengaged, to be collected. The bottom of the boiler being cleaned, heated water was thrown in from the forcing pump, the elastic fluids produced flowed through a flexible tin pipe which was attached to the stop cock *a*, (Plates 1 and 2,) and passed into a tub containing water. At the end which dipped into the water, there was a stop-cock, opening and closing the pipe at pleasure; the cock *a*, was always open. On the first day's trial, a small quantity of water, previously placed in the boiler, was allowed to boil away; the bottom of the boiler was heated to redness, and water injected. The stop-cock being opened under a receiver, in the tub serving as a pneumatic cistern, a gas which issued through the flexible tube was collected, the water condensing the high steam with which the gas was mixed. The smell of this gas was empyreumatic, an opaque white vapour came over with it, which disappeared on standing. Half a pint of the gas was collected for examination. The injection of water being continued, the gas ceased to come over.

This gas was subsequently examined; it was a non-supporter of combustion, was not combustible, did not render lime water turbid; it was, in short, nitrogen gas, with perhaps a small admixture of oxygen.

These observations were considered as only preliminary to a more extended examination of the subject. The theory which makes the decomposition of water, by heated metal, produce hydrogen, and this gas by its union with oxygen, produce explosion, has been supported by many, and deserved a respectful examination. The difficulty of finding the oxygen for the hydrogen to recombine with, has been ingeniously, though, as we conceive, not successfully, parried. The fact, that though water is decomposed by heated iron, hydrogen gas decomposes heated oxide of iron, has also been plausibly urged and supported by collateral evidence, of a similar nature, drawn from the action of heated copper upon ammonia.

To study the subject in detail, it was necessary to examine the relative effects of hot and cold water; the relation between the quantity of gas produced, and of water injected, at different temperatures of the bottom of the boiler; and to raise the temperature of the metal so high that no objection on that score should exist to the results. Moreover, the oxidated surface was to be removed, and the boiler exposed to the action of the water in as clean a state as the nature of the case admitted. The gas was collected in graduated jars, the water drawn in by the forcing pump was taken from a measure, and the quantities injected noted. The time was also noted between the experiments.

The conclusions to which the committee were brought, render a detailed exhibition of the experiments unnecessary, except so far as such a statement may go to show the degree of care which was used in prosecuting the subject, and thus to give confidence in the results. The experiments of the *first* day in which the gas was collected as already described, were tentative, they served to render the methods of experimenting more precise.

On the *second* day, one of the glass plates in the boiler-head cracked, and the escape of gas with the steam, through the crack, rendered the results as to quantity, inconclusive. The gas was uniformly found to extinguish a candle, and not to burn itself. The mercury in the iron tube into which the thermometer N, Plate 1, dipped, soon boiled; the thermometer had been previously removed. The thermometer in the other tube M, was observed as giving an indication of whether the temperature within was increasing or diminishing.

It was now distinctly seen that the air which furnished the nitrogen gas, before referred to as issuing from the boiler, was not derived from the water injected. The injection of one fluid ounce and a quarter troy (2.25 cubic inches) of water, never gave less than 2.6 cubic inches of gas, and sometimes notwithstanding the leakage, gave 17.28 cubic inches. But water absorbs, according to Saussure, from 5 to $5\frac{1}{4}$ per cent. of its bulk of atmospheric air, giving for 2.25 cubic inches only .118 of a cubic inch of air, not one-twentieth part of the minimum quantity of gas derived from the boiler by the injection of 2.25 cubic inches of water. On observing closely the cracked glass plate, it was seen, that after a certain period in the production of steam by the water thrown into the boiler, the vapour ceased to issue through the crack, and finally, that a bending inwards of the pieces of glass indicated that the pressure within the boiler was less than that without, and that atmospheric air had access to the interior. As no inflammable gas had as yet been obtained, and as the gas which issued was nitrogen mixed with oxygen, the entrance of air into the boiler was obviously the source of the gas collected.

A new glass plate was substituted, on the *third* day, for the broken one, and a copper plate was screwed upon the opposite opening of the boiler, which was thus rendered as tight as the nature of the apparatus permitted. The experiments were made at regular intervals, varying in different parts of the series from sixty to ten seconds, and in such a manner, that the bottom of the boiler might be found in nearly the same state, in some of the experiments, with each interval. The interval was counted from the time at which gas ceased to issue in a previous experiment, to the instant of injecting water. The unit of measure of the gas was 1.8 cubic inches. The results were as follows.

Fluid ounces of water injected.	Interval in seconds.	Measures of gas collected.	Ounces of water injected.	Interval in seconds.	Measures of gas collected.	Ounces of water injected.	Interval in seconds.	Measures of gas collected.
½	60	10†*	½	30	5	½	10	4
"	30	10†	"	"	9	"	60	10¾
"	"	10¾	"	"	8	"	10	6
"	"	10¾†	"	10	6	"	60	7
"	20	10	"	"	5	¾	10	5
"	"	8	"	30	10¾†	¾	10	4
"	"	6	"	10	10			
"	10	6	"	"	7			
"	"	7	"	"	5			
"	30	5	"	60	6			
"	"	9	"	"	10			
"	"	8	"	20	6			
"	10	6	"	10	4			
"	"	5	"	60	7			

* The numbers marked (†) signify that an unmeasured portion of the gas escaped.

In this series we remark, first, that the mean result for an interval of 60 seconds, is 8.5 measures; for an interval of 30 seconds, 9.1 measures; for 20 seconds, 7.5 measures, and for 10 seconds, 6.9 measures.

If atmospheric air leak into the boiler, the air will enter until the pressure within and without become equal. Hence an increase in the interval between two experiments in which the air should be expelled, would, above a certain point, be attended with no increase in the quantity of gas which would be expelled; the only effect being to consume, more completely, the oxygen of the entering air. Up to this point an increase of interval should be attended by an increase of air which would leak in, and consequently by an increase in the amount subsequently expelled. The mean results given above do, in fact, show an increase in the quantity of gas obtained after an interval of 20 seconds, over that obtained for 10 seconds: of 30 seconds over 20 seconds. They give a slight decrease from the interval of 30 seconds to 60 seconds, which will find its explanation on a further examination of the results.

Second; we observe from the table, that after a number of short intervals, the succeeding long interval never gave as much gas as when the long interval had been repeated; and, vice versa, that after a series of long intervals, the next succeeding short interval gave a higher result than that which followed. The experiments, with an interval of 30 seconds, were not as much interspersed among the short intervals, in the last part of the series, as were those of sixty seconds; the mean of the results for this latter interval is therefore diminished.

No increase in the amount of gas was obtained by increasing the quantity of water injected. The mean of four experiments, when the bottom was at a glowing red heat, and the thermometer seven and three-quarter inches from the bottom, at from 553° to 559° Fah., was 5.75 measures for 1½ ounces of water; from 572° to 580°, by the same thermometer, 10.5 measures for the same quantity of water injected; above the range of the scale of the same thermometer, 12 measures for 1½ ounces, and about the same quantity for 2 ounces. During these experiments, mercury, which was on the top of the boiler, in a clay receptacle, boiled freely. The best evidence is thus given that the bottom of the boiler was not wanting in heat; it was, in fact, at a bright red heat during the last part of the experiments.

The peculiar odour, before remarked, as belonging to the gas expelled from the boiler, still continued, indicating the presence of sediment within the boiler; this could be seen when the metal was glowing. A scale of oxide also appeared on the bottom, which now and then cracked, presenting irregular luminous lines as the boundaries of the scale.

The experiments just detailed were, on a succeeding day, repeated, to ascertain whether the same results would be reproduced. The bottom of the boiler being at a bright red heat, an interval of 60 seconds gave, as the mean of four experiments, 11.5 measures of gas for one ounce of water injected; an interval of 30 seconds gave, as the mean of five experiments with three-fourths of an ounce of water, 13 measures; an interval of 20 seconds gave, as the mean of four experiments with half an ounce of water, 10.6 measures: and again, in a second series, the same interval gave 10.5 measures for the mean of four experiments with five-eighths of an ounce of water. Towards the close, the numbers for 10 seconds of interval were very variable, the mean of six experiments with .65 ounces of water, injected when the boiler was at a cherry red, was 6.3 measures of gas; with a heat which, to all appearance, was the same, the gas collected diminished to 3.5 measures, and averaged 3¾ measures at a bright red heat. For an interval of 5 seconds, with 1¾ ounces of water injected, 4½ measures of gas were obtained. The conclusions to be drawn from these results agree with those already deduced from the previous experiments, which were thus confirmed. The gas collected was carefully transferred, over water, to the laboratories, where it was analysed. One specimen yielded Professor Hare, nitrogen with seven per cent. of oxygen; another, examined by Professor A. D. Bache, gave nitrogen, and 9⅓ per cent. of oxygen: in each case the results were obtained by exploding a mixture of the gas with hydrogen.

The boiler was now thoroughly cleansed, that the scale of oxide upon the bottom might be removed; in doing this, the hand-hole was necessarily removed, and had to be repacked. Paper was placed between the glass plate at the back end of the boiler and its metallic covering, that the boiler might be tightened. To ascertain the amount and direction of the current setting into, or out of, the boiler at any time, a copper pipe, terminating in a glass tube, was attached to one of the stop-cocks on the head, at the fire end of the boiler, the glass tube dipping into a vessel containing water.

The injection water was, on resuming the experiments, heated over a small furnace, to boiling, in a metallic vessel, from which it was drawn by the pump. When the bottom of the boiler was at a bright red heat, the lowest thermometer had attained a temperature of 570°, and was soon after removed. The quantity of water thrown in at each stroke of the pump, was now by no means so regular as when the action of the pump was not impeded by the formation of steam within it, from the injection water. The results obtained were:—

No. of strokes of pump.	No. of measures of gas collected.	REMARKS.
2	2	Injection water hot.
"	½	Redness not visibly diminished by water injected.
2	3†	Bright red. Experiments made after a rest. Gas puts out candle.
2	3¾	Bright red. Do.
2	1½	Do. Do.
6	3	Do. Gas burned at mouth of jar with a blue flame.
1	¾	
1	½	Gas burns with blue flame.

A combustible gas had appeared for the first time. The injection water was now changed for cold water, and a gas obtained, which burned as before; 11 measures of air and one measure of the gas detonated slightly, also one to 8½ measures of air; neither detonation was sufficiently violent to extinguish the candle held at the mouth of the jar in which the gases were fired.

The gas now came over, not in copious bubbles and during a short time, but slowly and continuously, as if resulting from a constant, but not violent, chemical action. After these results had been obtained, the violent and brief bubbling, when the water was injected, recommenced, and the combustible gas was no more obtained. The change of hot injecting water for cold, and the collection of the combustible gas after the change, showed that the gas was not derived from any effect produced by the increased temperature of the liquid introduced. The other circumstances which had been different from those of former experiments, were the superior cleanliness of the bottom of the boiler, and the repacking of the hand hole with cloth, oil and putty, and of the glass window with paper. Before proceeding to the detail of the experiments, in examination of the source of the combustible gas obtained, it may be well to mention that the glass tube, already spoken of, showed, after the water injected in some of the experiments had evaporated, a current of air, due to a force equivalent to a head of from ½ to 1½ inches of water, from the exterior into the boiler; in one experiment it is noted that the water, in the tube referred to, soon fell, which indicated a leak in some part of the boiler.

On the day following that upon which the experiments just given, were made, nothing conclusive was obtained; no combustible gas appeared, but the heat was hardly as high as on the preceding day. Small disks of wood, thrown into the boiler, gave a combustible gas, which came over just as was noticed in relation to the inflammable gas of the preceding day's experiments. That these inflammable gases, in mixture with the oxygen, remaining in the atmospheric air, within the boiler, produced no explosion, is in accordance with the well known fact in relation to them; pure hydrogen, in such a mixture, combines with oxygen under the influence of a body heated to redness.

On the following day of experiment, circumstances proved entirely favourable; the bottom of the boiler was heated as intensely as on the former occasion. After much incombustible gas had been obtained, traces of an inflammable one appeared. A strong smell of oil was noticed about the hand hole, at the back end of the boiler; the packings were now white on the exterior. The fire was urged, and the boiler became strongly heated throughout its whole length. The following results are from the journal of the experiments.

	Appearance of Boiler.	No. of Measures of Gas.	REMARKS.
Each stroke of the pump threw in 5-8ths of an oz. of water. The gas is that collected by one stroke of the pump.	Bottom bright red,	16	Candle burns feebly in gas.
	do.	10½	A piece of paper put against back hand hole is charred.
	Very bright,	14	Wood put at back end of boiler (outside) charred. Paper browns on top. Gas puts out candle.
	do.	7	Gas puts out candle.
	Heat same (about) as first day of finding inflammable gas,	8	
	do.	8	
	do.	7½	Wood chars at fire end (outside) being the less heated end.
	Heat greater,	5	
	do.		Gas extinguishes candle and does not burn.
	do.		No smell of oil gas. Wood at both ends charring. Paper on top of boiler charring.

No combustible gas was procured in these experiments, though the circumstances were more favourable to the production of hydrogen, by the boiler, than on other occasions. On examining the cloth packing of the hand holes at each end, it was found to have disappeared, except in spots; the putty was white. The boiler was not dirty enough to colour, with oxide of iron, clean water which was introduced.

These results point conclusively to the packing, as the source of the combustible gas obtained. The flame of that gas was that of carburetted hydrogen, and not of pure hydrogen. They further show that even in this intensely heated state of the bottom of the boiler no hydrogen was liberated by the decomposition of the water injected.

In conclusion, it appears from these experiments:

1. That the gas obtained by injecting water upon the bottom of a boiler which was at a bright red heat, was nitrogen gas, with a variable quantity of oxygen: it was, in fact, atmospheric air deprived, by the heated metal, of more or less of its oxygen.

2. That this air was derived, principally, from the current into the boiler when surcharged steam had ceased to be formed, and the boiler was left dry; there will, therefore, be no such quantity in a working boiler, where the air must be supplied from the cold water thrown in.

3. That water in contact with heated iron in a steam boiler, the surface being in its ordinary state, clean, but not bright, is not decomposed by the metal.

VIII. To observe accurately the sort of bursting produced by a gradual increase of pressure within Cylinders of Iron and Copper.

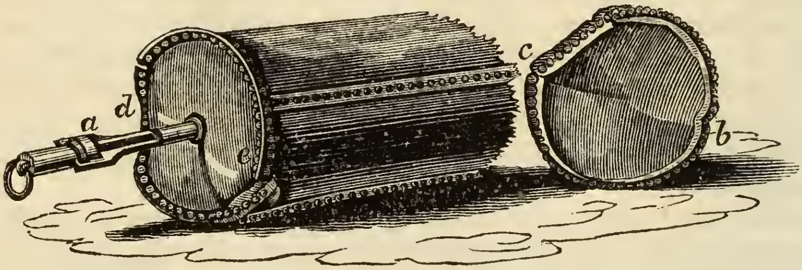
It has been contended by some, that ruptures produced by a gradual increase of pressure within steam boilers do not bear the character of explosions, but that a mere rending takes place, giving escape to the contents. This has been assumed to be especially the case with copper boilers. To make the observation required by the above question, cylinders of iron and copper were prepared, of sufficient size, to make a small thickness of material answer for rending by a pressure which was easily attainable. Two experiments made, one with an iron and another with a copper cylinder, afforded so direct an answer to the query that it was not deemed necessary to carry the experiments further, especially as they were tedious, and not without danger. A further experiment of the same tenor, resulted from a trial of Perkins's assertion in regard to the effect of making an opening in a vessel containing water, and heated to a high temperature.

The boilers used were cylindrical, eight and a half inches in diameter, and ten and twelve inches respectively in length, of iron .02 inch thick, and of copper .03 inch thick, having iron heads .05 inch thick, to which the convex surface was fixed by iron rivets, placed nearly touching each other. A single opening in the middle of one of the heads of each boiler was provided to introduce the water, and was furnished with a screw, into which to insert a tube and piston, connected with a small spring weighing machine, which is represented at *a* in the cut on page 224. Upon the cylinder of this machine a ring was placed, which was moveable along the cylinder by a slight pressure: this ring was forced towards the end of the cylinder nearest to the boiler head, as the spring was bent and remaining in its place when the spring relaxed, served to register the maximum pressure to which the piston had been exposed previous to observing it.

The iron boiler was placed in a heavy cylinder of wrought iron, which served as a furnace, the axis of the boiler being nearly horizontal, and that of the furnace cylinder vertical. The boiler, having been half filled with water, was placed upon a fire of charcoal, and when the water boiled, the register machine for the pressure was screwed in.

The place selected for the experiments was in a deserted quarry on the banks of the Pennypack, near Holmesburgh. The high bank served as a protection, by the aid of which the experiments were viewed with little danger. A wire and cord were attached to the head of the boiler, to draw it from the fire when the latter required to be replenished. A leak in the riveting of the iron boiler allowed so much steam to escape that the boiler did not give way on the first trial. As soon as the escape of steam was observed to cease, the boiler was removed from the fire and again half filled with water. The fire was urged, and the boiler settled lower into it, and by once replenishing the fuel, without removing the boiler, an explosion was produced. Part of the committee were engaged in observing the progress of the experiment at this moment. The fire was near the middle line of the boiler, burning not strongly near that line, but very rapidly below the boiler; the steam issued freely through the leak before alluded to, and the whistling sound which it produced, and which had increased gradually in strength as the experiment progressed, seemed constant. The length of time during which the steam had escaped showed the water to be low, and induced the supposition that a second time the object would fail; when an explosion occurred. The explosion tore off one of the heads, *b c*, of the cylinder, projecting the other parts of the boiler in an opposite direction, carrying with them for a portion of the distance, the iron cylinder forming the furnace, and scattering the fuel in every direction. The report attending the explosion resembled that from a small mortar (eprouvette) fully charged, the steam mixed with the smoke was not considerable in quantity, and few marks of water were to be seen. The boiler head was thrown fifteen feet, the boiler and spring register about six feet, and the furnace, weighing about forty-five pounds, was overturned and carried four feet. The pressure indicated by the register was eleven and a quarter atmospheres.

In examining the boiler it appeared that the head, *b*, which was thrown off, had first struck against the iron furnace, which had deflected it outwards; this is shown by the indentation, *b c*, in the figure. This head was forced off all around in the line of rivets which attached the head to the boiler, the metal remaining between the rivets being less than the space occupied by them. The convex surface and the other head were thrown likewise against the furnace, and the head indented at *d e*, overturning the furnace and carrying it four feet, as already stated. The boiler finally struck against the side of the bank of earth. The piston of the weighing machine was somewhat bent in the experiment.

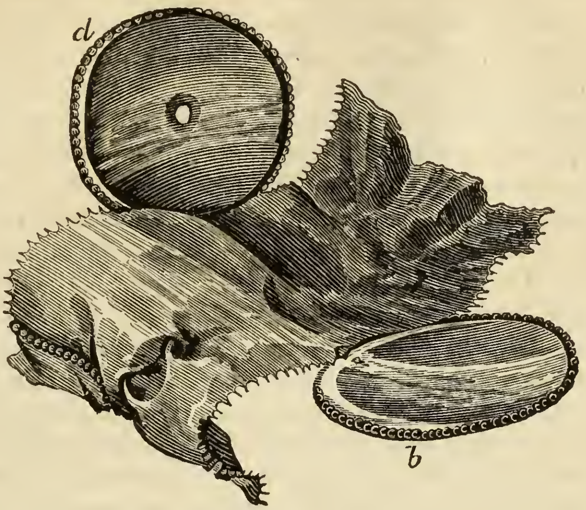


The circumstances of this experiment show that the steam rose quite gradually on account of leaks in the boiler, increasing, probably, more rapidly as the quantity of water diminished, the intensity of the fire meanwhile increasing. That at a certain period the tension within had attained about eleven atmospheres, when the boiler *exploded violently.*

The accompanying figure will serve to give an accurate idea of the appearance of this boiler after its rupture.

The cylinder of copper, before referred to, was next put in the place of the iron boiler, and the fire again kindled; the general arrangements being as before described. This boiler being longer than the former would not descend so far into the furnace, and an attempt to raise the steam sufficiently high to burst it failed: there was a considerable leak in the junction of the curved surface with one of the ends. When the water was nearly exhausted, the fire having passed its period of greatest heat, the cylinder was removed and water again introduced, filling about three-fourths of its capacity. A new furnace was constructed of stones, allowing the boiler to rest more closely upon the fuel and affording a screen from the wind which was blowing quite strongly. The part of the boiler in which the leak had been observed was turned downwards, but a similar escape was found for the steam in the part now uppermost. The tension of the steam appeared to increase very slowly, and the fire passed its best action without effect; it was renewed, and as the water became lower the tension of the steam increased considerably. As before, nothing remarkable occurred previous to the instant of explosion, and the members of the committee, employed in the experiments, were engaged in observing the boiler at the instant it exploded. A dense cloud of smoke and flame, capped by steam, rose from the pit; the stones and combustibles were widely scattered, and the boiler was thrown, in a single mass, about fifteen feet from the furnace. The noise attending this explosion was like that from the firing of an eight inch mortar.

The boiler was rent as shown in the accompanying figure, giving way in an irregular line just above the probable water line on one side of the boiler, but not conforming to it. *d* and *b* were the lowest points in the two heads before the explosion. The sheet of copper was torn from the heads, unrolled and irregularly bent, adhering to the heads for only a short distance near the top of each; and the heads were bent outwards. The thickness of the copper along the line of rupture varies from .025 to .035 of an inch, and the metal appears to have been highly heated at one end of the torn portion. The piston of the spring gauge was bent, the screw which attached it to the boiler broken, and the whole instrument otherwise injured; it appeared that the wire intended to draw the boiler off the furnace had slipped and impeded the action of the piston, so that no register of the amount of force producing this explosion was obtained.*



The circumstances, as before, show that the steam was allowed to rise gradually until the boiler gave way. It is possible that there may be a relation between the space occupied by the water and that in which the steam is formed most favourable to the production of steam, and that when this was attained a rapid rise in elasticity took place; but there were no circumstances observed which would confirm such a view, and if it were correct it would only affect the conclusion as far as the increase of tension might have been rapid from such a cause.

As in the former case the marks of the sediments remained in the boiler, and indicated that the water was about an inch deep when the cylinder exploded. Much more steam was formed, and more water left than in the first experiment.

These experiments, together with the one referred to in a subsequent part of this report, are direct and conclusive; they show that *all the circumstances attending the most violent explosions may occur without a sudden increase of pressure within a boiler.* There can be no doubt, however, that if particular portions of a boiler are much weaker than other parts, they may give way in time to prevent such a catastrophe.

---

* Assuming the strength of copper at 36,000 lbs. to the square inch, and that it was uninjured by the heating, neglecting also the effect of temperature, the bursting pressure appears by calculation, to have been about sixteen atmospheres. It was, no doubt, less than this.

IX. To repeat Perkins's experiments, and ascertain whether the repulsion stated by him to exist between the particles of intensely heated iron and water be general; and to measure, if possible, the extent of this repulsion, with a view to determine the influence which it may have on safety valves.

The first trials upon this subject were made under atmospheric pressure. An iron bowl, about $\frac{1}{16}$th of an inch thick, and having the bottom perforated with small holes, was heated to redness over a charcoal fire, and water poured into it; the mass of metal being small, was cooled down very rapidly to a temperature below redness, and the repulsion which was at first manifested between the water and iron ceased, and the water flowed rapidly through the apertures. Two thicker bowls were provided, one of wrought iron, $\frac{3}{8}$ths of an inch thick, and the other of cast iron, seven-sixteenths of an inch thick; the bottom of each was perforated with holes, about .04 of an inch in diameter. When placed over a charcoal fire and heated to redness, water poured in so as to fill the bowls, reduced the temperature of the wrought iron one most rapidly, but until the reduction was effected, the results were the same as those for the cast iron bowl. In this latter the water rested upon the bottom without passing through the holes, either as water or as steam; steam formed slowly and escaped from the upper surface, the whole fluid being at a temperature below the boiling point. The openings were distinctly to be seen, and appeared by measurement to have contracted about $\frac{1}{7}$th part of their diameter; but the repulsion was such as to render the escape of the water quite as difficult, and indeed more difficult, than that of mercury at ordinary temperatures. Removing the vessel from the fire, the water remaining in it, as the material cooled below redness, small particles of water came through at intervals; at a lower temperature large drops collected, which finally united into a full stream. Some rude measurements of the quantity of water which came through when the iron was heated in water at different temperatures, showed a striking diminution at the higher temperatures. These results were obviously not produced by the closing of the apertures as the bowl expanded by heat, the openings being distinctly visible at a red heat.

The measurements referred to above were as follows: at 58°, $3\frac{5}{8}$ fluid ounces of water passed through the holes, in the cast iron bowl above referred to, in thirty seconds; the whole quantity of water added, being four ounces.

In another experiment at 60°, $3\frac{3}{4}$ fluid ounces passed. Water at between 58° and 60° being thrown into a bowl previously heated to 82°, $3\frac{1}{4}$ fluid oz. passed through; when heated to 170°, $2\frac{7}{8}$ oz. passed in the same time, and when heated to 660° about $2\frac{1}{16}$ oz.

In another series, the same bowl being heated to redness, four fluid ounces of water thrown in were perfectly repelled for 15 seconds, and at the end of half a minute only $\frac{3}{8}$ths of an ounce had flowed through the openings.

Of a second quantity of four ounces thrown into the bowl thus cooled, $1\frac{5}{32}$ oz. passed in 30 seconds, next $2\frac{1}{4}$ oz. in the same time.

These experiments show that the amount of the force of repulsion between water and heated metal, is measurable even at moderate temperatures, and rapidly increases with the increase of temperature of the metal; the temperature of the water being in each case, of the last set of experiments, nearly the same. They confirm, in this respect, the results of the vaporization of water by metal at different temperatures.

The pressure of the column of water which was supported over the lowest of these openings at a temperature between 660° and a red heat, or 800°, was less than one inch and a half of water.

The committee now proceed to give an account of an unsuccessful attempt to repeat Perkins's experiment referred to in the query. As it does not seem to bear upon the application of the safety-valve, they did not deem it necessary to encounter the expense of the apparatus necessary to a further trial.

The experiment of Perkins, which is more particularly referred to in the query, is that in which an opening having been made in one of his generators, containing intensely heated water in contact with red hot metal, neither steam nor water escaped, and in which having affixed a pipe and stop-cock to the same vessel, no steam issued through the cock when opened. To repeat this with a view to ascertain, as required in the query, the size of opening to which such a result would apply, three apertures were made, $\frac{1}{16}$th, $\frac{1}{8}$th, and $\frac{1}{4}$th of an inch respectively, in the sides of a wrought iron mercury-bottle; these were closed by conical plugs connected with levers, by which the plugs could be withdrawn from the sides of the bottle. The fulcrums of these levers were attached to the wrought iron cylinder already referred to, within which, its axis coinciding with that of the cylinder, the cylindric bottle was placed. An earthen-ware furnace was placed below the bottle and surrounding cylinder, the latter resting upon wrought iron bars supported by the edges of the furnace, and the former supported by a stone placed upon the grate of the furnace. Besides affording a support for the levers, the wrought iron cylinder was introduced to protect the experimenters against injury, should the bottle explode in the trials to be made with it. This apparatus having been placed in a quarry pit, adjacent to that in which the cylindric boilers were burst, water was poured into the bottle so as to fill it, the screw plug was next passed into the neck and forced home by lateral blows from a hammer: a fire was now made in the furnace, and the fuel heaped up so as to fill the entire space between the mercury bottle and wrought iron cylinder, and to be about five inches deep above the stopper of the former. A string was attached to the lever connected with the smallest plug, and carried up the bank. The fire soon burned briskly, and it was perceived that a small quantity of steam mingled with the feeble smoke and heated air which rose above the apparatus. About twenty minutes after the beginning of the experiments, the leak appearing to increase, an incautious attempt was made to stop it, but without success; at this time the bottle was seen to be at a dull red heat. It was thought that but little water had been able to escape in steam through the very minute opening which the imperfect thread of the screw gave, and it was intended to withdraw one of the plugs, when a few minutes should have elapsed to give time for the bottle to be heated to complete redness. Meanwhile a most violent explosion occurred, the body of the bottle rose in the air, the iron cylinder which served to increase the height of the furnace, was thrown from its place, the earthen furnace blown to pieces, and the fire scattered far and wide through the woods. After extinguishing the fire, it was found that the iron cylinder, weighing, with the apparatus connected with it, 61$\frac{3}{4}$ lbs, had been thrown four feet from its bed: the plugs which passed into the bottle had been broken short off at the exterior of the bottle; the bottom had been forced into the ground, which was ploughed up by the fragments of the furnace, and completely wet for a considerable distance around; one of the iron bars supporting the cylinder was thrown to a distance of thirty feet, and sunk three inches into the ground. The body of the bottle was found thirty yards from its position before the explosion, having penetrated two feet into the ground. The noise of the explosion resembled that of a twelve pounder fully charged.

This experiment proved, first, that steam, from intensely heated water, was able to penetrate an exceedingly small opening. Although it proved nothing in regard to an aperture made in a vessel containing water only, it showed an effect produced when there was very little steam in the vessel. It verified the deduction, from theory, that but a small part of water, highly heated, can expand into steam, if suddenly relieved from pressure. It showed that great danger must be incurred in attempts to heat water very highly, even in vessels where it has but little room to expand itself, contrary to the opinions entertained by many: and that an attempt to repeat the experiment of Perkins, unless with an apparatus capable of sustaining the most intense pressures, must be attended with great danger.

The wrought iron bottom of this bottle was welded upon the convex surface, and a portion of the welding appeared defective, but generally it was sound. The bottom having been torn from the convex surface, or from lateral portions, the strain was a transverse one, and, from calculation, could not have been less than ten atmospheres.

X. *To ascertain whether cases may really occur when the safety valve, loaded with a certain weight, remains stationary, while the confined steam acquires a higher elastic force, than that which from calculation would appear necessary to raise the valve.*

CONSTRUCTION AND GRADUATION OF THE SAFETY VALVES.

Of these there were two used at different times, the same in construction. They were disk valves, as shown in figure B, Plate 4, the valve seat was .515 inches in diameter, in each, and the diameters of the valves .70 of an inch. The stem *r*, to which the disk *p*, was attached, passed through the half collars *o* and *o'* which served as guides. On the point terminating the upper end of the stem, pressed the lever *l*, *m*, for receiving the weights. The fulcrum of the lever was a knife edge, resting in a curved opening in the upright *e*, which was screwed into the boiler. (See also K, Plate 1.) The apparatus was graduated by trial, in order that the friction might be duly estimated. The valve, lever, &c., being in place, a delicate balance beam *f f*, graduated to inches and tenths, on each side of the edge *g*, which was its axis, was so placed, fig. B, that one of the divisions was vertically above a small hole made in the valve stem; to this division a cord *h h'* passing through the hole, was attached. A scale pan was hung to a division *k*, of the opposite arm of the balance, and the string and pan made to balance by weights on the arm *f h*. The string being now stretched by a weight rather greater than the probable amount which it would have to bear in the graduation of the valve, the beam was made horizontal. Weights were then placed in the scale pan, until the weight of the lever, the stem and disk, and the friction, being overcome, the valve rose from its seat. This rise was indicated at the end *l*, of the valve lever, by an upright placed there for the purpose. Next a convenient weight was placed in the pan, and the point ascertained on the arm of the lever at which a small weight, assumed, balanced it. Thus several points were determined. In graduating the first safety valve *gh*, was 4.4 inches and *gk* 11 inches, so that the weight raised at *h* was two and a half that applied at *k*. The weight of the lever &c., balanced 24 oz. troy at *k*, or $24\times2\frac{1}{2}=60$ oz.$=5$ lbs. troy at *h*. This weight rested on an effective surface of .515 inches in diameter, or .232 sq. ins. in area. It was equivalent, therefore to 24.04 lbs. troy to the square inch, or to 19.78 lbs. avoirdupois; that is to a pressure of 1.35 atmospheres of 14.68 lbs. corresponding to 30 inches of mercury.

A weight of 6 oz. being at *d*, near the end of the lever *l m*, was balanced by 56 oz. at *k* on the arm of the balance. To determine from this the ratio of *d m* to *n m*, we have $\frac{56\times2\frac{1}{2}-60}{6}=\frac{80}{6}=13\frac{1}{3}$, which coincided nearly with the ratio given by measurement, being a little in excess.

At the mark *d*, 6 oz. together with the weight of the lever, &c., and friction, produced a pressure of 3.14 atmospheres, and the weight used in the experiments, 9.369 oz. troy, produced a pressure of 3.27 atmospheres, exclusive of atmospheric pressure.

At the mark *c*, called in the experiments the *third* mark, 9 oz. balanced 56 at *k*, and the weight 9.369 oz. together with that of the lever, &c., produced a pressure of 2.63 atmospheres.

At the mark *b*, the *second mark*, 12 oz. were required to balance 56 at *k;* the pressure produced by 9.369 oz. &c., was therefore, 2.31 atmospheres. At *a*, the first mark, 15 oz. balanced 56 at *k*, and the pressure from 9.369 oz. &c., was 2.12 atmospheres.

The experiments with these valves, will show why the committee are so particular in giving the data upon which the graduation was founded. The details in relation to the second valve were as follows.

The string from the valve stem was attached to the mark five, on the balance beam, and the scale to the mark ten on the opposite arm; when $29\frac{1}{2}$ oz. troy at ten, balanced the weight of the lever &c., at five. This weight was therefore 59 oz. troy or 4.04 lbs. avoirdupois: pressing upon a surface of .515 inches in diameter, or .208 sq. inches in area, it was equivalent to 19.44 lbs. to the square inch, or to 1.32 atmospheres of 14.68 lbs. At the last mark, near the end of the lever, a weight of $2\frac{3}{4}$ oz. balanced 49 oz. at the mark ten on the beam of the balance; the weight 3.76 oz. which was used in the experiments together with the weight of the lever, &c., produced therefore a pressure of 2.52 atmospheres.

At the mark next to the end, called in the experiments the second mark, the same weight together with the lever, &c., produced a pressure of 2.10 atmospheres.

Weights of 2.64 oz. and of 5.28 oz. were also prepared to be attached to the mark near the end, the weight of 3.76 oz. being prepared with hooks to adapt it to this purpose. The smaller weights produced an additional pressure of .84 of an atmosphere, and the larger of 1.68 atmospheres.

On the Performance of the Safety Valves.

The committee, with a view to test the performance of the safety valve, selected the form calculated, in their opinion, to be most serviceable in practice, a disk valve. One of these valves was attached to the boiler. This was in action in the different experiments, and was tested by comparing with the temperature of the water within the boiler and with the steam gauge, when this latter was in use; the results were rendered more valuable from the fact that one of the valves having been injured in the experiments on highly heated steam, a second one had to be put in its place and to be graduated anew. The pains bestowed in this graduation enabled the committee, not only to compare the pressure at which the valve opened when similarly weighted in different experiments, but to compare the pressure given by calculation from the area of the valve, &c. with the actual pressure at which the valve allowed a free passage to the steam. Any adhesion of an unusual character could not have escaped detection. The valves were kept in good working order, but no unusual pains were bestowed upon them, and the experiments ranged through more than two years of interval, irregularly continued. They therefore give quite as severe, if not a more severe, trial, than in a working apparatus. The following tables contain the results of the experiments and the comparisons, necessary to give an entire view of the subject.

The first column of the first table gives the observed temperatures of the steam, the pressure of which raised the safety valve, weighted as expressed in the third column; the pressures corresponding to these temperatures are given in the second column. An abstract of the first table is given in the second; it contains the mean, the highest and lowest observed pressures, and the range of pressure. The pressure at which the valve should have opened, according to calculation, and the ratio of the calculated pressure to the mean is also furnished by the last two columns of the same table.

Table First.

Observed Temperature.	Corresponding Pressure.	Situation of Weight.	Observed Temperature.	Corresponding Pressure.	Situation of Weight.
Fah.°	Atmospheres.		Fah.°	Atmospheres.	
255¼	2.1	Valve without weight, except that of lever, &c.	281½	3.4	Weight at second mark.
"	"		279½	3.2	
260¼	2.3		283½	3.5	
257¼	2.2		286½	3.7	
253¼	2.1		281½	3.4	
"	"		277½	3.1	
251¼	2.0		279½	3.2	
255¼	2.1				
271½	2.8	Weight at first mark.	284½	3.5	Weight at third mark.
272½	2.8		287½	3.7	
269½	2.7		291½	4.0	
277½	3.1		283½	3.5	
272½	2.8		285½	3.6	
276½	3.1		285½	3.6	
272½	2.8		291½	4.0	At last mark.
277½	3.1		292½	4.1	
	2.8		297½	4.5	
			293½	4.2	

TABLE SECOND.

Weight.	Mean pressure.	Highest pressure.	Lowest pressure.	Range.	Calculated pressure.	Ratio of calculated to observed.
No additional weight	2.12	2.3	2.0	0.3	2.35	1.11
First mark	2.90	3.1	2.7	0.4	3.12	1.07
Second mark	3.36	3.7	3.1	0.6	3.31	0.98
Third mark	3.65	4.0	3.5	0.5	3.63	0.99
Last mark	4.2	4.5	4.0	0.5	4.27	1.02

The performance of this valve is shown by the table to have been so far satisfactory that the greatest range of pressure between the highest and lowest observations, at any position of the weight, is .6 of an atmosphere. While, therefore, no accurate investigation of the elasticity of steam could result from the use of such a valve, it is found to answer, so far as these results can show, the requirements of practice. In regard to the ratios of the average observed pressures to the calculated pressures, they range from .98 to 1.11, and at a mean the ratio is 1 to 1.034, a ratio which would produce, at higher pressures, marked differences between the calculated and observed pressures.

In a paper by M. Garnier, in the Annales des Mines,* vol. 8, the results of his comparisons of safety-valves, having a considerable projection over their valve seat, with others having a small projection, are given, and are very worthy of attention. He found that a valve, the disk of which projected upon the valve seat beyond the opening of the seat .4 of an inch, opened at a pressure within the boiler, of only two-thirds of that shown by a mercury gauge, and that the distance to which the weight upon the lever of the valve required to be placed from the fulcrum, in another case, for a pressure of four atmospheres, was that corresponding to five atmospheres, if the pressure of the air on the upper part of the valve were estimated. With a disk projecting but .02 of an inch the ratio of the calculated pressure to the observed was 1.06 to 1.

The experiments above quoted, with a disk projecting .1 of an inch, give a less ratio than is indicated by M. Garnier, and show besides that the phenomena are not constant, the individual experiments varying more from each other than the mean varies from the calculated result. The fact developed by M. Garnier is attributed by him to a want of perfect contact between the disk and its seat, and the variations observed by the committee go to strengthen this opinion. Different positions of the disk, different states of its surface, and the interposition of small particles of dirt will satisfactorily account for the want of uniformity in the pressure at which the valve opened when all circumstances were *apparently* the same. Further evidence on this head will be gathered from the results furnished by the second safety-valve. This it will be recollected, was of the same form and dimensions with the first, and similarly graduated. In the following table the observed temperatures and pressures are given, at which the valve, circumstanced as stated in the column headed remarks, opened. The mean pressure, the highest and lowest pressures, and range, are given in the next four columns. The calculated pressure, and the ratio of the mean pressure to the calculated, are in the next two columns.

---

* Second series.

TABLE THIRD.

Observed temp.	Corresponding pres.	Mean pressure.	Highest pressure.	Lowest pressure.	Range.	Calculated pressure.	Ratio of calculated to mean pressure.	REMARKS.
Fah °	Atmos.	Atmos.	Atmos.	Atmos.	Atmos.	Atmos.	Atmos.	
257¼	2.2							Up. No weight.
259¼	2.3	2.25	2.3	2.2	0.1	2.32	1.03	
271¼	2.8							Leaks badly. One weight at 2d mark.
271½	2.8							
270½	2.7	2.77	2.8	2.7	0.1			
275½	3.0					3.10	1.03	Valve up.
277½	3.1							Not fully up.
"	"							
"	"							Weight at end.
"	"	3.1	3.1	3.1	0.0			
279½	3.2					3.52	1.09	Valve up.
286½	3.7					4.36	1.10	One additional weight.
296½	4.4							Leaks freely. Two additional weights.
299½	4.6	4.5	4.6	4.4		5.20		Leaks freely.
305½	5.1							Leaks freely. Three additional weights.
307½	5.3							Up.
308½	5.4	5.27	5.4	5.3	0.1	6.04	1.15	Up.
313¾	5.9					6.88		Leaks. Four additional weights.
317¾	6.3							Leaks freely. Five additional weights.
319¾	6.5	6.5	6.5	6.5		7.72	1.19	Up.
319¾	6.5							Leaks freely. Marked 4 wts. but was probably 5.
327¾	7.3							Leaks. Six additional wts.
333¾	7.9	7.6	7.9	7.3		8.56	1.13	Up.
329¾	7.5							Leaks.
338¼	8.3							Leaks. Six additional wts. and four oz. troy.
344¾	9.0					9.85		
351½	9.8					11.12		Leaks. Six additional wts. + eight oz. troy.

The weights used in the experiments were verified after their conclusion, and found to be accurate. The ratios of the calculated pressure to the observed increase, and afterwards decrease, showing that the results are not attributable to inaccuracy in the unit of weight which was successively applied. They are not explicable by a defect in measuring the valve seat, as is shown by the nearer coincidences at the lower pressures, when the ratios are much nearer to unity than in the higher.

This valve was fitted, by grinding, twice during the experiments, but that the contact with the seat was not perfect, is shown by the number of times at which leaking is noticed before the rise of the valve; these leaks at the high pressures became very sensible, and increased rapidly, from the instant of their first appearing, to that at which the valve opened.

The mean ratio of the calculated to the observed pressure is 1.10 to 1, but taking for comparison with the first valve, the same range of pressures as was calculated for the first, the ratio is as 1.04 to 1, differing but little from the ratio obtained for the first valve.

This defect in the safety-valve, which affects its use as a means of judging of pressure in proving boilers, is increased as the pressure increases, and may cause an inadequate proof by the forcing pump, or the hydraulic press. No adhesion of an undue kind is shown, by these experiments, to have taken place with the second valve, the difference of pressure of opening and of undue leakage, under similar circumstances, being moderate. The experiments, it should be remembered, apply only to disk valves, and not to those of a conical form.

XI. To ascertain, by direct experiment, the effect of deposits in boilers.

The committee have been fortunate on this head in obtaining the account of the results, on a large scale, furnished by the deposits in the boilers of boats on our western waters; to these they refer, as showing,—

1. That deposits, consisting of sedimentary matter, carbonate of lime, and other salts, collect in particular parts of boilers, and, preventing the communication of heat to the water, are baked hard, becoming "as hard as brick," when the water is low.*

2. That these collections of mud, &c. may, by causing the undue heating of the bottom of a boiler, produce exfoliations of oxide, which gradually reduce the thickness of the metal; or they may allow the temperature of the metal to be raised so high, that it swells out by the ordinary pressure of the steam, and finally bursts. Thus leading, gradually or suddenly, to the weakening the boiler, and to the discharge of its contents.†

The committee have also examined cases of similar deposits in iron boilers, using spring (hard) water. They consisted chiefly of the carbonates of lime and iron, mixed with oxide of iron, containing, besides, the earthy salts from the water. Unless removed at short intervals, they form in the ordinary use of the boilers, and without undue heating, exceedingly hard crusts upon the bottom of the boilers, requiring the aid of the chisel for their removal. Retarding the passage of heat into the boiler, they lead to a great waste of fuel; and exposing the bottom to be unduly heated, they destroy the boiler gradually, by wear, if not suddenly, by explosion.

The nature of these deposits, and the rapidity of deposition, varies, of course, with the kind of water which is used.

[TO BE CONTINUED.]

---

* Explosion of boiler of steamboat Caledonia, W. Littlefield, p. 310, vol. viii., Jour. Frank. Inst. Anonymous, p. 310, ib. Matthew Robison, p. 311, ib. E. W. Benton, p. 314, ib. Also, L. Hebert; p. 379, ib. Thos. W. Bakewell, p. 386, ib. Thos. J. Halderman, p. 28, vol. ix.

† Col. S. H. Long, pp. 244–5, vol. viii. Prof. Johnson, at monthly meeting of Institute.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Calcareous Cements. By JAMES FROST, Civil Engineer.

No. III.*

The affinities of lime for the following substances have been classed by chemists, and seem to have been neglected by them as of little importance, or interest; this has probably arisen from their feeble action at low temperatures, and from chemists not being aware of the value of the investigation. As the temperature increases, the affinity of lime increases for all the substances named, becoming at length very intense. Under atmospheric pressure only, at a bright red, or nearly white heat, in the dark, water and carbonic acid separate from lime without decomposition; under increased pressure, they remain in combination, the carbonate of lime forming into a solid, resembling marble. As the temperature increases, the other substances combine with the lime, and undergo partial decomposition, losing oxygen, which is taken by the lime, and retained by it at common temperatures. This fact, and some other curious laws, have been hitherto unregarded, yet will be found of great importance to the right understanding of the subject we have in hand.

The affinities of lime are regular and constant, as must be expected by all who understand chemistry; they are in the following order.

For Protoxide of Silicium.
For " of Manganese.
For " of Iron.
For Carbonic Acid, or Deutoxide of Carbon.
For Silex, or Peroxide of Silicium.
For Alumine.
For Water.

When we examine the lowest of these affinities, that of water, we shall find it of surprising energy; yet, great as it is, and greater as the preceding ones must necessarily be, as they all displace it, these immense forces are singularly limited by some curious laws, which I shall hereafter endeavour to develope, and also to show, in detail, the peculiar action of magnesia, soda, potassa, hydrogen, sulphuretted hydrogen, carbon, &c., which, in many cases, exerting peculiar and important influences, will, of necessity, require considerable detail. Indeed, when it is considered how many elements are included in these combinations, the necessity of detail will be apparent, to render them easily understood, and extensively useful.

When pure lime is moistened with pure water, twenty-eight parts of lime enter into chemical combination with nine parts of water, and form what is termed hydrate of lime. Any superfluous water may be readily expelled from the hydrate, by exposing it to a heat a little above that of boiling water; but the nine parts of water remain fixed at a red heat, and require a heat white in the dark for their expulsion. When the substances are pure, and in sufficient quantity, they become instantly red hot on admixture; a fact well known by the frequent accidental firing of combustible matter in this way. That this combination is permanent at a red heat, may be easily proved by trial, and that it requires a more intense heat for their separation, is evident from the following experiment. 100 grains of hydrate were enclosed in a small platina crucible, to which a cover was luted, having only a small tubular aperture in the centre, and being placed in a reverberatory furnace, at a white heat, became equally hot in five seconds; after the lapse of a minute, a cold iron bar was held, for a few seconds, over the aperture of the crucible, and on withdrawing the bar, a drop of condensed water was appended to it; at intervals of a minute, other bars exhibited the same appearance for nearly a quarter of an hour.

---

* No. 2 was published in the December number of this Journal, vol. xvi., p. 377.

The great heat developed in slacking lime, has been hitherto attributed to the latent heat of the water being set at liberty on its assuming a solid form in the hydrate. Now, the heat that ice absorbs in becoming fluid, is 140°, but the red heat of the water in the hydrate is at least 700°
and as the lime is also heated to the same degree, and as the specific heat of lime, compared to that of water, is as .2199 to 1, if we multiply the latent heat of the former by $3\frac{1}{9}$, we shall find the heat of the lime, 467

1167
Deduct the latent heat of water, 140

Remaining unaccounted for, 1027
Being more than seven times the latent heat of water, and which we must leave unaccounted for at present.*

That water is not decomposed in combining with lime, is proved by heating one hundred grains of hydrate in a platina retort, connected with an air-tight condenser, expelling the water from the hydrate, and, when cool, returning the same water on the same lime, several times in succession; no extrication of hydrogen, or sign of decomposition, will occur. As the water held by lime at a red heat, would, if not so held, form steam of immense elasticity, it follows that the cohesive force of lime and water is a still greater force. This expansive force of red hot steam has been differently stated by Rumford, and by Perkins; the lowest statement of the former is 50,000 atmospheres to the superficial inch, more than twelve times the cohesive force of bar iron. What a wonderful exhibition of the power of chemical attraction!

The same compound is formed when lime is exposed for a length of time to the air, from which it certainly, though slowly, absorbs the vapour that may be present in it, and, as we shall hereafter see, with the same proportionate extrication of heat, although, being so slowly extricated, it has hitherto escaped observation by our senses, or by our instruments. Lime, thus air-slaked, as it is termed, also absorbs carbonic acid, and is thus injured, in some degree, for good mortars, and this fact is pretty well appreciated. But its absorption of oxygen seems to have been little regarded, although it is the great source of its use for medical purposes; it is a fact, however, that lime absorbs in slacking, and subsequently as a hydrate, a considerable quantity of oxygen, and hence its use in disinfecting; for, by absorbing oxygen, it liberates nitrogen, which, combining with putrid miasmata, renders it innoxious, or neutral, and, if carefully used, is probably as useful an article as the more expensive, and less well known substances, used for that purpose; but all these absorptions, however useful for particular purposes, are injurious, where good mortar is the object required.

These absorptions of gas are visible by slacking some lime in a cup floating on water, and covered with an inverted glass jar, furnished with an opening, and a stop cock, to equalize the internal and external pressure of the air; on closing the cock, the water will be found to ascend in a jar containing atmospheric air, or oxygen gas, and to be stationary in a jar filled with hydrogen. As we shall pursue this investigation with more advantage in a similar examination of cements, we will now proceed to see how easily this intense action between water and lime may be modified, delayed, or suspended, and to show that the art of doing so was known at a very remote period—has been long lost or abandoned—perhaps, on the use of gypsum, being discovered; and how the art may, if revived, be prosecuted with more advantage, or be superseded by improved modes.

---

* Our correspondent here assumes that water, in combining with lime to form a solid, is in the same condition as when frozen; a conclusion which seems untenable.
Com. Pub.

As it is necessary, in all admixtures of two or more solid substances, for the purpose of forming any new chemical compound, that their respective particles be previously reduced to an impalpable or indiscernible state, we shall, in future, always consider this as having been effected.

If 100 grains of chalk-lime be mixed with 200 grains each of the substances named in the following table, be tempered with water to the consistence of mortar, and be placed on a plate of glass, they will exhibit the appearance indicated in the table, previous to slacking; and if the quantity of many of the substances is further increased, the lime will not slack at all in dry situations; but, however the other substances may be increased in quantity, or the lime be varied in quality,—however near they may be thus made to approach in appearance to real cements, they will always be found false cements, by immersion in water, as, either on setting, or at considerable and uncertain times thereafter, they fall in pieces, and are likely wholly to disintegrate.

The second column indicates the time occupied in setting to resist a moderate impression of the finger, and the temperature of compound; the third and fourth columns, the times occupied in attaining sufficient hardness to receive a visible mark from a black lead pencil, and of a leaden point; the fifth, the time occupied in slacking, or falling to pieces, which they did, as it were, inside, while hardening externally; indeed, some attained sufficient hardness to receive a distinct mark from a brass point, while becoming rotten internally.

Substances.	Set in	Black Lead.	Lead.	Slacked.
Cast-iron,	1 minute, hot			15 minutes.
Wrought-iron,	5 minutes, hot	5 minutes		6 minutes.
Emery,	4 minutes, hot		2½ hours	7 minutes.
Glass,	10 minutes, warm	15 minutes	4 hours	3 days
Copper slag,	12 minutes, warm	20 minutes	20 hours	9 days
Deutoxide lead,	9 hours, cool	12 hours		24 hours
Peroxide iron,	35 minutes, tepid	40 minutes	3 days	50 minutes
" manganese,	50 minutes, tepid	105 minutes	75 mins. tepid	
" tin,	30 minutes, tepid	40 mins. tepid	3 days	10 days
Silicious sand,	2 minutes, hot	3 minutes	14 hours	
Calcined pure alumina,	3 minutes, warm	5 minutes		
Calcined magnesia,	Never remade at 2 days	4 days	10 days	
White marble,	8 minutes, warm	12 minutes	3 hours	4 days
Chalk,	15 minutes, warm	30 mins. hot		65 minutes
White marble, 300,	30 minutes, cool	1½ hours hot	6 days	Permanent
Chalk, 300,	25 minutes, cool	40 mins. tepid	4 days	Permanent

The ancients were, doubtless, in the habit of using cements like the last two. A friend, Mr. Bignell, brought me, three years since, a fragment of an enriched ceiling from Pompeii, which he saw in a state of great preservation; on analysis, I found it a nearly pure carbonate of lime, and, while sound, as hard as alabaster; perfectly free from those minute cracks always found in hydrate compounds of lime, formed from pure carbonates.

I have entered rather fully on this subject, not only to illustrate an intricate branch of science, but to give a warning against the use of certain mixtures under the impression that they are useful cements; these, we shall find, may be abundantly procured from many sources hitherto unknown, certain in their action, and cheap in their formation. Before I abandoned the investigations undertaken for finding some useful compound, similar to the last, I tried the compounds of lime with charcoal, coke, sulphur, various metallic oxides, stones, raw and calcined clay, mixtures of alcohol, acetic acid, sugar, treacle, and oils; all of which have the property of delaying, or suspending, the chemical combination of lime and of water, but none led to any useful results.

We will now endeavour to see the real nature of water mortars, or mixtures of pure limes with various substances with which they harden under water, with more or less rapidity; when withdrawn from water, they sometimes continue to harden, sometimes cease their hardening, and sometimes, as it is said, unharden; we will not only endeavour to show how this arises, but show, also, how any one may easily understand these facts, and compare the action of any substance hitherto untried, with those that have been long and well known.

When pure lime is immersed in pure water, it is readily dissolved, provided no more lime is introduced than will saturate the water; and if, in any saturated solution of lime, any lime remains undissolved, and any of the lime in solution is withdrawn by the chemical action of any substance introduced into the solution, the water immediately takes up another portion of the undissolved lime, and always continues in a saturated state. The solution, when exposed to the atmosphere, quickly becomes covered with a crust of carbonate of lime, which defends the solution from farther admixture of carbonic acid; and thus the actions about to be described, take place by virtue of chemical affinities between the lime and water, and other substances, without combination with, or any reference to, carbonic acid, which we shall hereafter find to have peculiar and independent affinities; should any doubt remain on this subject, the experiments may be repeated, with the same results, in air-tight glass jars.

It has long been known that tarras, which is principally a silicious substance, and puzzolano, which differs from tarras, principally, by containing a little more oxide of iron, will, each of them, when reduced to an impalpable state, and well mixed with an equal weight, or more or less, of pure hydrate of lime, and tempered with water to the consistence of mortar, and placed under water, gradually concrete, harden, and become like stone; that, if withdrawn from the water, they almost, or altogether, cease from hardening, and, if returned to the water again, continue to harden to a great degree. It is not so well known, but is equally true, that they may, by merely beating them up, or turning and well chafing up with a shovel, at frequent intervals of a few days, be kept under water, or in moist situations, for a great length of time, without hardening, and without any injury whatever to their subsequent hardening when replaced under water, and suffered to repose; for, though these substances harden greatly in time, say a year, yet the hardness they acquire is almost imperceptible, say in ten or twelve days; and frequent and thorough stirring of them always restores their original plasticity.

It is also well known that hydrate of pure lime, tempered with water to the consistence of mortar, with any quantity of silicious sand, and placed under water, will never harden, but, on the contrary, if placed in a current of water, the lime will be wholly dissolved, and carried away; but it is also equally true, that if the silicious sand is reduced to an impalpable state, previous to, or after, admixture with the hydrate, the mixture will harden gradually under water; and it is also equally true, that a similarly formed mixture of hydrate, and of calcined pure alumina, will harden under water, and that neither of these substances harden so readily, or so much, under water, as tarras, or puzzolano, which are both principally composed of them, as will be seen by looking at the analysis of these substances, which I shall hereafter give; nor will a mixture of silica and pure alumina, in the proportions in which these substances are found in clays, (pipe clay, for instance, being a compound of one part of alumina, and three of silica,) calcined or uncalcined, be found to set and harden, when tempered with lime, and placed under water, so well as those substances do separately, as before stated; but they all do harden, more or less. We will hereafter explain the cause of their different behaviour; at present, we will endeavour to show why or how, they harden at all.

Chemists have stated as a general law, that when any two substances enter into chemical combination, one or both of them must be, at the time, in a state of fluidity. I have never seen it stated, but, from long consideration I believe it to be the fact, that when three or more substances enter into chemical combination, two or more of those substances must be then, or have been at some previous time when in contact, in a fluid state.

Now, to apply this law, is to explain the rationale of the hardening of water mortars. The hydrate of lime, a solid, is mixed with the tarras, or puzzolano, or, in other words, is associated with silex, another solid, and placed in fluid water; now, the lime is soluble in this water, and its solution, coming into contact with the remaining solid, (silex,) for which lime has a greater affinity by far than for water, it quits the water, and attaches itself to the silex, and the water, being again at liberty, dissolves another portion of lime, to be again, in its turn, attached to the silex; and, in favourable circumstances, this proceeds till the soft mixture is indurated, and becomes a hardened mass.

That this is a true and faithful representation of the wonderful change produced in these substances, is rendered undeniable by the following experiment, which I made to test the opinion just given.

Into a basin of water, was introduced a plate of glass, on which was laid small and separate particles of coarse grains of tarras, of puzzolano, of silex, of alumina, of protoxide of iron, or common forge scales, of coarse fragments of Roman cement, and other substances likely to attract the lime, and to concrete with it into masses; and on another part of the glass was laid a small piece of quick-lime, which, slacking, was dissolved by the water; the water soon became saturated with lime, covered with a protecting coat of carbonate; the lime was attracted with more or less force to the different, distinct, and distant substances, from the water, and there were, after the lapse of a few days, found concrete masses of lime, and of the respective substances, more or less advanced in hardness, and the hardness so obtained was in direct proportion to, and was an evident measure of, their respective affinities for lime; and are evidently, also, superior to that existing between lime and water. Now, this experiment accounts perfectly for the hardening of water mortars, for their ceasing to harden when withdrawn from water, and for their again continuing to harden when replaced in water. Why they sometimes continue to harden out of water, and sometimes to retrograde, as well as why tarras and puzzolano harden better than the principal elements of which they are composed, whether those elements be combined or uncombined, will all be satisfactorily shown when we have made some necessary farther advances in our inquiries.

On Surrendering and Renewing Patents under Amended Specifications. By the Editor.

In the last volume of this Journal, p. 313, in noticing a patent obtained by Mr. C. J. Gayler, of New York, for manufacturing iron chests, we remarked that the patent originally issued to Mr. Gayler for these chests, had been vacated in the District Court of the United States for the Southern District of New York, in consequence of defects in the specification, and expressed a doubt whether, under these circumstances, the new patent could be sustained. By referring to the notice here alluded to, the reader will find a brief statement of the grounds upon which that doubt was founded. Our attention has been since called to this subject, and upon further reflection we are apprehensive that our first impressions upon this point may prove to be incorrect; we have also conversed with two gentlemen of the bar respecting it, who believe that a patent which has been declared void by a court, may, under the act of July 3d, 1832, be surrendered to the Secretary of State, and reissued under an amended specification. This act provides that whenever a patent "shall be invalid or inoperative, by reason that any of the terms or conditions prescribed in the third section of the act [of February 21st, 1793] have not, by inadvertence, accident, or mistake, and without fraudulent or deceptive intention, been complied with on the part of the said inventor, it shall be lawful for the Secretary of State, upon the surrender to him of such patent, to cause a new patent to be granted," &c.

All the patents which had been surrendered subsequently to the passing of this act, and prior to that by Mr. Gayler, were, we believe, surrendered upon a conviction existing in the mind of the patentee, that he had not complied in the first instance with the requirements of the law, and that his patent would not, therefore, be sustained if carried into court. There does not, however, appear, in the wording of the law, any thing to prevent the surrendering of a patent after it has been declared void by a jury, as this does no more than prove it to be "invalid and inoperative," and appears, therefore, to place it in the precise condition in which the relief contemplated by the act is to be afforded. Until this has been done, the patent is not absolutely "invalid and inoperative," however strong the conviction may be that such would prove to be its condition, if subjected to the ordeal of the law.

The foregoing view of the operation of the law appears to be much more consonant with justice than that first taken by us, as a patentee might, undoubtedly, surrender his patent, had his errors been discovered by himself, or by his friends, and it would be no small hardship, were the remedy denied because they had been detected by an adversary.

It may be proper to observe, that a reissued patent stands precisely upon the same basis with that originally obtained; that is to say, the surrender and reissuing do not of themselves give to it any validity, but only afford an opportunity to render it valid. The patentee may still claim more than he has invented, or the whole thing patented may be without novelty, and stand no better chance of being sustained than it did in the first instance. We could point to several reissued patents, which we believe to be in this predicament, and which must remain so, until the Ethiopian can change his skin, and the leopard his spots.

Physical Science.

Essays on Meteorology. By James P. Espy, Mem. Am. Philos. Soc., &c.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—I send you now, for publication, the first of a series of essays on rain, hail, and snow, water-spouts, land-spouts, winds, and barometric fluctuations, in which, I hope, it will be found that I have successfully traced these phenomena to their true causes.

The announcement that these essays were about to be published, was made in a communication of mine, in the Journal of the Franklin Institute, in 1834, and they have only been withheld with a view to accumulate such a mass of facts, as would place the theory on an immovable foundation. Such a mass has now been collected, and I promise the reader, in advance, that he will find developed in the following essays, a law in meteorology, which, founded on acknowledged dynamical principles, explains at once, with a simplicity which nothing but nature can equal, all the *seven* phenomena mentioned above.

The importance of this law will readily be admitted, when it is understood that by it may be known whether there is a great storm raging at any time within four or five hundred miles of the observer, and also the direction of that storm, with the means of avoiding it, if the observer is at sea.

Yours, &c.

James P. Espy.

No. I.

Theory of Hail.

It has been shown by the experiments of Berard and Delaroche, and also by those of Clement and Desormes, that the specific heat of atmospheric air is about .250, that of water being one.

Now, if these experiments are correct, and they appear to be so, it will be easy to account for the formation of rain, snow, and hail, and several other atmospheric phenomena, which have never yet been satisfactorily explained.

The theory of these meteors may be given in a few words. When a portion of transparent vapour, in the air, is condensed into cloud, or water, *the latent caloric given out expands the air containing it six times as much as it contracts by the condensation of the vapour into water.*

This general principle will be most easily explained by calculating a particular case. Suppose the weight of vapour in the air to be one-sixty-fourth that of the air, which is the fact when the dew-point is about 71° Fah. Now, if all this vapour should be removed from the air, the diminution of bulk, on the supposition that the specific gravity of vapour is .625°, that of air being one, would be .045 of the whole.

As it is known that the sum of the sensible and latent caloric of the vapour of water is always equal to 1212° Fah., if we subtract 71°, the dew-point assumed above, from 1212°, it will leave 1141° for the latent heat of vapour at the temperature of 71°. As this latent heat would raise the temperature of sixty-four times its weight of water, 17.8°, it will raise the air in which it is supposed to be condensed, four times that quantity, or 71.2°. Now, if air at the temperature of 32° be raised 71.2°, it will be expanded 0.15ths of its whole bulk, nearly, which is six times its contraction from the condensation of its vapour into cloud, or water.

The calculation here made is undoubtedly low, for the mean temperature of the air to which it is intended to apply, as will be seen hereafter, is below 32°, and though the capacity of air is increased by a diminished pressure, yet it is believed that that increase will be more than counterbalanced by the 140° of heat given out, in the case of hail, at the moment of congelation, for which no allowance is made in the above calculation.

It follows, then, from the principle here demonstrated, that the moment a portion of transparent vapour in the air begins to condense into cloud, the air in which it is contained begins to expand, and, consequently, if an equilibrium existed before, it is now destroyed, and the cloud will continue to ascend as long as its temperature is greater than that of the surrounding air.

Without examining its condition every instant of its ascent, let us imagine it to have ascended three miles and a half, or 6000 yards, where the pressure of the surrounding air is about half that at the surface from which we suppose it to set out. In consequence, then, of occupying a double space, the dew-point would be 50°, provided none of the vapour is turned to water. On the same supposition, the temperature of the air would fall, in consequence of expansion, one degree for every hundred yards of ascent, if it preserved the same relative temperature to the surrounding air which it had at first, and its temperature would then be 11°. But this temperature is impossible with a dew-point of 50°, for the temperature could not fall below 50°, without bringing the dew-point with it.

From necessity, therefore, the dew-point must fall below 50°, to a point where latent caloric enough is evolved by the condensation of vapour, to heat up the air from 11° to that point.

I find, by calculation, that if the dew-point sinks sixteen degrees below 50°, $\frac{121}{375}$ths of the whole vapour in the air will be condensed, and this will heat the containing air 23 degrees, the excess of which over the 16 degrees of depression will make up the difference between 11° and 50°. Thus it appears that the temperature of air, when it has ascended 6000 yards, with a dew-point of 71° at its commencement, will have a dew-point of 34 degrees, and be 23 degrees warmer than the surrounding air at that elevation. In like manner it may be shown, by assuming other points at greater elevation in this upward motion, that the difference of temperature between the air in the vortex, and the surrounding air, is constantly increasing with the elevation, until the moment when the vapour is all condensed into water, when it will be 71.2° higher, as was shown before. After it passes this point, it will continue its motion upwards, *dry*, and, of course, not increasing in temperature beyond 71.2° higher than the surrounding air, but will preserve this difference until it reaches the surface of the atmosphere, where it will spread itself out, and come to rest. We have now a column of air reaching from the surface of the earth to the surface of the atmosphere, of the same temperature as the surrounding air below, and 71.2° greater above, making a mean of 35.6°. Now, the mean temperature of the surrounding air may be taken as low as 32 degrees, and, consequently, the expansion due to these 35.6° will be $\frac{356}{480}$ths of the whole height of the atmosphere; and as the atmosphere would be 27,000 feet high, if it were throughout of the same density as at the surface of the earth, the expansion will be $\frac{35\cdot6}{480}$ of 27,000 feet = 2070 feet. This vortex column, then, is pressed upwards with a force equal the weight of a column of air of the density at the earth's surface, 2070 feet high, and will move upwards, as is demonstrated in mechanics, with a velocity in feet per second $= \sqrt{2070} \times 8 = 364$, which is 4.13 miles per minute, or 218 miles per hour. Nor is this great velocity at all incredible, for the upward motion in the vortex is as much greater than the horizontal motion of the air towards the vortex, as the motion of the air in a chimney is greater than the horizontal motion of the air in the room towards the fireplace.

I am aware that several corrections would have to be made to the numbers used above, if strict numerical accuracy were my object. For example, it is probable that the air in the higher regions contains, as Mr. Ivory asserts, more caloric to the pound than in the lower regions, for it is the upper air which receives the latent caloric given out in rains, and snows, and hails; but this correction would vary the result so little, that, for the sake of simplicity, I have chosen to neglect it. Besides, the truth of the theory does not at all depend on the numerical accuracy of the above calculation. It is believed, indeed, that the latent caloric given out by congelation, would, after all the other corrections were made, be sufficient to turn the scale in its favour; but, even if it should be found otherwise by a closer investigation than I propose now to give the subject, the truth of the theory cannot be touched, unless it shall be discovered that the experiments on the specific caloric of atmospheric air, mentioned above, are erroneous to a degree altogether incredible. For, if the capacity of air should be found to be four times as great as supposed above, I find, even then, that the latent caloric given out on the formation of a cloud, would cause an expansion just double the contraction from the condensation of the vapour, and *that*, too, without the assistance of the caloric given out by congelation. And even this small expansion, calculated on the principles laid down before, would give an upward velocity of 100 miles per hour.

As the result here deduced is so extraordinary and unexpected, it will, no doubt, excite chemists to determine, with the greatest care, the specific caloric of atmospheric air, as this is the only point concerning which any doubt remains, on which the theory advocated depends. The latent caloric of vapour, the expansion of air by heat, and its velocity upwards for a given expansion, are perfectly known.

In the meantime, let us see how the theory will explain the phenomena. It is confidently believed that no theory will stand the test of examination, which will not show how, in the case of hail, drops of rain are first formed, and then frozen. This theory readily accounts for this circumstance; for, when the dew-point is high, and near the temperature of the air, condensation of the vapour into drops of rain will take place near the surface of the earth, in the ascending vortex, and these drops will increase in size until they are carried up far beyond the region of perpetual congelation, where they will be frozen. That very large drops will be carried up while they are in the ascending vortex, will readily be admitted, when it is recollected that the velocity of the ascending vortex was demonstrated to be about 364 feet per second, even when the dew-point was taken at 71 degrees. If the dew-point had been taken at 80 degrees, a much greater velocity would have been the result. It is known by experiment, that when common atmospheric air moves with a velocity of one foot per second, its impulse on a square foot of surface, perpendicular to its motion, is sixteen grains; and as the force of all fluids is as the square of their velocity, the force of air in the vortex, on the supposition of its density being equal to common air, would be $\overline{364}|^{2} \times 16$ grains, about 361 lbs. on each square foot of surface. But as the air in the vortex, at the height to which hailstones may be carried, is probably not more than one-third the common density, the actual force of upward impulse, at this great elevation, is only one-third of 361 pounds to the square foot; a power still sufficient to raise a cube of ice one and a half feet in diameter.

I hope it will not be considered a decisive proof against my theory, if it fails to account for hailstones, said to have fallen in the reign of Charlemagne, fifteen feet long, six feet wide, and eleven feet thick; nor of those which fell, or are said to have fallen, in the reign of Tippoo Saib, as large as elephants; for these accounts are probably exaggerations.* And yet, if we suppose the vortex perpendicular, and the dew-point high, its power would be sufficient to raise an elephant some distance, but certainly not so high as the region of perpetual congelation. We have certainly many authentic accounts of hailstones weighing half a pound, and more. Pouillet has given an account of a hail storm which extended from the Pyrenees to the Baltic, on the 13th of July, 1788, in two bands, parallel to each other, about fifteen miles apart, in which space there was a great rain. The eastern band was, at a mean, about six or seven miles broad, and the western about twelve miles. The rain, however, was on the outside of these bands of hail, as well as between them. The progress of the storm from the south-west to the north-east was about fifty miles per hour, and the hail continued to fall not more than eight minutes at any one place, yet the devastation was immense, the largest of the hailstones being about eight ounces.

If I had made this storm myself, it would be said that I had made it to illustrate my theory. For it is manifest that the out-spreading of the vortex above, will, in many cases, carry with itt he hailstones, and those which are least the farthest, and these smaller hailstones, on the outside of the bands, will melt before they reach the earth, while the larger hailstones, falling more swiftly, and having more ice to melt, may reach the earth in the form of hail. Thus the two veins of hail, and the rain on the outside of them, are manifestly accounted for; it is not quite so plain why it should only rain in the middle. Nevertheless, if we consider that the vortex moved with a velocity of fifty miles an hour from the south-west to the north-east, we will readily perceive that, as it would require perhaps twenty or thirty minutes for the drops of rain to be carried up to their greatest elevation, and to fall down to the earth, during which time the vortex would move forward twenty or twenty-five miles, neither hail nor rain could appear in front of the vortex, and as it could not fall in the middle of the vortex, being prevented by the force of the ascending air, whatever fell between the two bands of hail must have descended in the hinder part of the vortex, where the resistance might have been so great to its descent in the lower parts of the air, as to cause it to melt before it reached the earth.

---

* Pouillet, vol. iv., p. 836, et seq.

The correctness of this explanation acquires additional probability from the fact that, in hail storms, the hail almost always precedes the rain, as appears from the facts collected by Pouillet. After mentioning the facts connected with this remarkable storm, this highly enlightened philosopher says: "In explaining the meteor hail, there are but two difficulties, but these are great, and we may say, in advance, they remain above all the efforts which have been made to resolve them.

"First. To explain how the cold is produced which congeals the water, and then to show how a hailstone which has acquired sufficient volume to fall by its own weight, remains yet suspended in the air during all the time necessary to acquire a volume fourteen or fifteen inches in circumference."

These two difficulties have already been fully explained. But the power of the theory does not stop here. It explains all the showers of dust, and rains of blood, (which are only water holding clay in solution,) of which we have a great many well authenticated accounts. For, when the vortex reaches down to the surface of the earth, it is able to carry up large quantities of earth, as will appear from the following extract: "On the 6th of July, 1822, at 35 minutes past 1 o'clock, P. M., in the plain of Ossonville, six leagues WSW. of St. Omer, and six leagues SE. of Boulogne, clouds were seen coming from different directions, and uniting together rapidly over the plain; they soon formed but *one*, which covered the horizon. An instant after, they saw descend from this cloud a thick vapour, having the blueish colour of sulphur in combustion; it formed an inverted cone, whose base was in the cloud. After it passed from that place, it was discovered that it had made an excavation in the earth, in the form of a basin, twenty or twenty-five feet in circumference, and three or four feet deep in the middle. After tearing down a barn, and some trees, it passed on, a distance of two leagues, without touching the earth, carrying with it large branches of trees, which it threw out to the right and left with much noise. Having then arrived at an elevated wood, it tore off the tops of many oaks, and carried them over the village of Vendome, situated at the foot of the hill, on the east side of the forest. In this commune, it tore up by the roots a large sycamore, and carried it 600 yards. The meteor, during its whole course, was like a bullet, which strikes the earth, and rebounds, tearing up the earth in places, and from time to time throwing out from its centre globes of fire, and globes of sulphurous vapours, and branches of trees. In the village of Witcanestre, of forty houses, thirty-two were prostrated, with their walls all thrown outwards, and at Lambre, eighteen, chiefly built of bricks, were sapped to their foundations in the same extraordinary manner." Nothing is said of either hail or rain accompanying this meteor.

Another spout, almost exactly similar to this in violence, took place near Treves, on the afternoon of the 25th of June, 1829. Suddenly, from the middle of a black cloud, about 20° above the horizon, a luminous mass began to move in an opposite direction, and to tear it open violently. The cloud near the top very soon took the form of a chimney, from which escaped a smoke of a whitish gray, mingled, at intervals, with jets of flame, and rising through several openings, with as much force (so several witnesses express themselves) as if it had been driven with great force by several bellows. It had not gone far, when a new meteor, as some thought, appeared in contact with the ground, nearly under the other, though a little behind, and producing great destruction.

One man, who was prostrated by the spout, affirms that there were two currents, in contrary directions. The path of the meteor was from ten to eighteen yards wide, as marked on the earth, and about 2100 yards long. It lasted about eighteen minutes, and, as seen at the distance of a mile and a half, it had the form of a serpent, of a hundred and forty feet long, with its head towards the NNE., and its tail opposite. It disappeared suddenly, and without explosion, and, almost immediately afterwards, hailstones of extraordinary size fell in the woods, to the NNW. of the place where the spout had passed. The sun did not appear during this whole time, and there was not a breath of air; at least, so several of the spectators affirm.

The various phenomena accompanying these two spouts seem to me to favour, in a most remarkable manner, the fact of upward motion; especially the manner in which the houses were prostrated by the first. Indeed, this latter phenomenon appears to me to be an experimentum crucis,—to prove that a light column of air was suddenly brought over the houses, thus prostrated; and by thus diminishing the pressure on the outside of the house, the elasticity of the air within produced an explosion, prostrating the walls outwards, and carrying off the roof.

An upward force which could carry off a large sycamore many hundred yards, must have been quite adequate to produce this effect, if it could be brought to act instantaneously, or even very suddenly, which, in the present case, the whole description of the phenomena induces me to believe was the fact. Now, the diminution of the weight of the column in the vortex, as estimated above, is more than a pound to the square inch, where the dew-point was assumed at 71°, which is a very moderate case, as the dew-point is frequently 75°, and sometimes as high as 80°, in this climate. Besides, a friend of mine informed me, that in a violent storm in Delaware Bay, he observed his barometer at 27 inches, which amounts to a pound and a half diminished pressure on a square inch; and it will appear, hereafter, that the barometer stood as low as 28 inches, near the termination of a spout in the Orkneys. If we take this low estimate, which gives one pound to the square inch, the force on a wall of a house from within, outwards, at the moment the vortex comes over it, supposing it to be 20 feet high, and 30 feet long, would be 46,120 pounds. One-tenth of this force would prostrate an ordinary wall.

Windows, also, have been known to have been burst open outwards, in this country, by a violent and narrow storm, attended with hail, even when the houses were not thrown down; but as this might sometimes occur when an open door might be directed to a horizontal current, it is not adduced here as proof positive that this effect was produced by an upward vortex. Nevertheless, as the same spout which burst out windows, also lifted up, and carried to a great distance, heavy materials, these facts may well be adduced as *favourable* to the theory. In one case, however, which may be considered very strong in favour of the theory, the roof was taken off from a barn, and the grain in the inside carried out at the top, without the walls being thrown down.

In the eighty-eighth volume of the Journal de Physique, page 274, is an account of a great many spouts, both by sea and land. One of these, in the the south of France, unroofed eighty houses, dispersed through the country the sheaves of corn which it carried out of a barn, broke the doors and windows of a chateau, and tore up the pavement in the middle of a room, without deranging some piles of china ware in it.

No one can doubt that the hail which fell almost immediately after the passage of the spout, was connected in some way with the spout itself. The manner of its connexion is fully explained by the theory. And even the perfect calm which reigned a short distance beyond the borders of the spout, which, in this instance, was very narrow, may easily be imagined from the outspreading of the air above, causing an increased pressure on the barometer, and thus preventing the air, beyond a certain distance, from moving towards the spout at the surface of the earth, and beyond this point, even causing it to move in an opposite direction.

The direction, also, in which the latter spout leaned, may also be accounted for on supposition that the upper part of it reached the current of air which, in higher regions of the atmosphere, is always moving from the south-west to the north-east; for, as soon as it reached that current, its upper part would be blown in that direction, and the spout itself would have to move in that direction with it. Moreover, the spout would be stationary, if it was formed in still air, until its upper part should reach this upper current, which might be twenty or thirty seconds, and this will account for the excavation of the earth under the place where the spout was seen to be formed.

Again, the theory will account for the rebounding of the spout,—that is, of its sometimes reaching the surface of the earth, and sometimes not. For, where the dew-point was very near the temperature of the air, *there* a very slight rarefaction of the air would produce cold enough to cause a condensation of the vapour, and so the vortex, with its condensed vapour, would be seen to reach the earth, and vice versa, where the dew-point should be many degrees below the temperature of the air.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Computations of the Principal Phases of the Solar Eclipse of May 15th, 1836, for several places in the United States. By SEARS C. WALKER, Esq.

The following computations of the principal phases of the solar eclipse of May 15th, 1836, have been made by E. O. Kendall, and duplicates of several of them by H. Wilson, from formulæ which I have prepared from the elements in the Nautical Almanac, after the method of Mr. Woolhouse. The beginning, greatest obscuration, and end, are given in mean solar time, May 15th, A. M., civil reckoning. I have examined them, and believe them to be correct.

	Beginning.	Greatest Obscuration.	End.	Digits eclipsed on Sun's south limb.	Latitude and Longitude.
Philadelphia,	7h. 3m. 32.8s. 319° 31′ 18″	8h. 13m. 26.1s.	9h. 32m. 17.8s. 103° 41′ 41″	7° 51′ 34″	39° 56′ 59″ 5h. 0m. 43.9s.
Baltimore,	6h. 56m. 20.8s. 319° 56′ 49″	8h. 5m. 16.4s.	9h. 23m. 1.1s. 103° 6′ 19″	7° 45′ 18″	39° 17′ 13″ 5h. 6m. 31.3s.
Washington,	6h. 53m. 51.5s. 319° 53′ 14″	8h. 2m. 32.9s.	9h. 20m. 05.1s. 103° 10′ 11″	7° 45′ 45″	38° 52′ 54″ 5h. 8m. 7.2s.
Harrisburg,	6h. 57m. 50.0s. 320° 47′ 23″	8h. 6m. 27.7s.	9h. 23m. 30.8s. 101° 55′ 15″	7° 34′ 3″	40° 16′ 5h. 7m. 20s.
Lancaster, Pa.	6h. 59m. 13.4s. 320° 19′ 50″	8h. 8m. 14.6s.	9h. 25m. 54.7s. 102° 34′ 54″	7° 40′ 29″	40° 2′ 36″ 5h. 5m. 22.2s.
Pittsburgh,	6h. 45m. 48.7s. 322° 55′ 1″	7h. 51m. 59.4s.	9h. 5m. 21.5s. 98° 44′ 32″	7° 3′ 29″	40° 32′ 5h. 20m. 32s.
Detroit,	6h. 39m. 31.1s. 325° 49′ 8″	7h. 43m. 29.1s.	8h. 52m. 30.1s. 94° 25′ 32″	6° 24′ 30″	42° 24′ 5h. 31m. 52s.
Buffalo,	6h. 55m. 59.0s. 323° 47′ 54″	8h. 2m. 42.8s.	9h. 16m. 5.5s. 97° 29′ 59″	6° 52′ 57″	42° 53′ 5h. 15m. 40s.
Rochester,	7h. 0m. 39.7s. 323° 21′ 14″	8h. 8m. 7.6s.	9h. 22m. 31.4. 98° 10′ 21″	6° 59′ 30″	43° 8′ 47″ 5h. 11m. 24s.
Troy,	7h. 15m. 59.6s. 320° 36′ 26″	8h. 26m. 31.3s.	9h. 45m. 28.5. 102° 9′ 32″	7° 38′ 15″	42° 44′ 4h. 54m. 40″
Schenectady,	7h. 15m. 9.7s. 320° 48′ 23″	8h. 25m. 30.2s.	9h. 44m. 10.2s. 101° 52′ 40″	7° 35′ 30″	42° 48′ 4h. 55m. 40s.
Princeton,	7h. 6m. 52.4s. 319° 29′ 41″	8h. 17m. 6.6s.	9h. 36m. 22.9s. 103° 47′ 18″	7° 52′ 47″	40° 22′ 4h. 58m. 20s.
Trenton,	7h. 6m. 18.3s. 319° 26′ 13″	8h. 16m. 30.7s.	9h. 35m. 46.9s. 103° 52′ 6″	7° 53′ 31″	40° 14′ 4h. 58m. 36s.
Haverford, Pa.	7h. 3m. 5.5s. 319° 43′ 3″	8h. 14m. 41.4s.	9h. 31m. 24.4s. 103° 27′ 56″	7° 49′ 17″	40° 1′ 12″ 5h. 1m. 26.8s.
Wilmington, Del	7h. 1m. 49.1s. 319° 32′ 1″	8h. 11m. 31.2s.	9h. 30m. 14.9s. 103° 43′ 18″	7° 51′ 40″	39° 41′ 5h. 1m. 52s.
Newcastle, Del.	7h. 1m. 31.2s. 319° 34′ 16″	8h. 11m. 9.9s.	9h. 29m. 49.1s. 103° 40′ 0″	7° 51′ 7″	39° 40′ 5h. 2m. 8s.
Dover, Del.	7h. 0m. 20.8s. 318° 47′ 50″	8h. 10m. 15.1s.	9h. 29m. 11.7s. 104° 13′ 45″	7° 56′ 30″	39° 10′ 5h. 2m. 0s.

These phases have been computed from the equations,

$$\cos \omega = 1.11107 - [0.16621] \sin l + [0.00414] \cos l \cos (\lambda - 56^\circ 49'.5)$$
$$\cos \omega' = 0.95633 - [0.15790] \sin l + [0.02242] \cos l \cos (\lambda - 41^\circ 27'.9)$$
$$\cos \omega'' = 0.70356 - [0.15000] \sin l + [0.03777] \cos l \cos (\lambda - 23^\circ 38'.2)$$
$$t = 1\text{h. } 57\text{m. } 24.0\text{s.} = + [3.53968] \sin l - [3.82162] \cos l \cos (\lambda + 82^\circ 43'.0) - [3.62430] \sin \omega$$
$$t' = 1\text{h. } 56\text{m. } 10.5\text{s.} = + [3.61296] \sin l - [3.86356] \cos l \cos (\lambda + 98^\circ 46'.5)$$
$$t'' = 1\text{h. } 35\text{m. } 45.1\text{s.} = + [3.68288] \sin l - [3.90746] \cos l \cos (\lambda + 116^\circ 59.'5) + [3.72245] \sin \omega''$$

Where,—

l = the latitude of a place + North — South
λ = the longitude from Greenwich + East — West
$(12h. + \lambda) + t$ = the local mean time of beginning, A. M. May 15.
$(12h. + \lambda) + t'$ = the " " " greatest obscuration.
$(12h. + \lambda) + t''$ = the " " " end.
$209^\circ\ 18'\ 13'' - \omega$ = angle for beginning.
$211^\circ\ 12'\ 37''$ = position of moon's centre for greatest obscuration.
$212^\circ\ 52'\ 26'' + \omega''$ = angle for end.
$[4.62355]\ (1 + \cos\omega')$ = digits eclipsed on sun's south limb.

The above angles of position are reckoned from north to the right, round the circle, as seen in a telescope that inverts.

In these equations, ω, ω', ω'', for the United States, are to be taken in the second quadrant. The sum of the apparent semi-diameters has been diminished 5″. If this correction for irradiation be rejected, the beginnings will take place 12.1s. earlier, and the ends 15.1s. later, than the times above given. These results agree very nearly with the rigorous computations in the American Almanac, and with the approximate computations in the same, with the single exception of Pittsburg, at which place, the beginning, greatest obscuration, and end, will take place thirteen minutes earlier than the times given in that publication.

Philadelphia, *March*, 1836.

Franklin Institute.

Minutes of the Board of Managers.

At a meeting of the Board of Managers, held at the Hall of the Institute, January 26th, 1836,

Mr. MATTHIAS W. BALDWIN was elected Chairman of the Board; and Messrs. FREDERICK FRALEY, and JOHN C. CRESSON, Curators, for the ensuing year.

And at a meeting of the Board, held February 17th, the Chairman nominated the Standing Committees, agreeably to the by-laws. On motion, Mr. MATTHIAS W. BALDWIN was added to the Committee on Publications, and Mr. JACOB PEIRCE, and Professor HENRY D. ROGERS, to the Committee on the Cabinet of Minerals; when the committees were appointed, as follows:—

On the Library.

Mordecai D. Lewis,
Isaac Hays, M. D.
J. Henry Bulkley,
William B. Reed,
Alexander M'Clurg,
Earl Shinn.

On the Cabinet of Models.

John Agnew,
John Struthers,
Joseph S. Walter, Jr.
John C. Cresson,
Isaac P. Morris,
Andrew M. Eastwick.

On the Cabinet of Minerals.

Isaiah Lukens,
Abraham Miller,
William H. Keating,
John C. Trautwine,
Samuel Hufty,
Jacob Peirce,
Henry D. Rogers.

On Publications.

Alex. Dallas Bache,
Samuel V. Merrick,
Isaac Hays, M. D.
M. W. Baldwin,
Rufus Tyler,
John C. Trautwine.

On Premiums and Exhibitions.

John C. Cresson,
Joshua G. Harker,
William H. Keating,
Frederick Fraley,
Isaac B. Garrigues,
Alexander M'Clurg,
Alexander Ferguson.

On Instruction.

Frederick Fraley,
Rufus Tyler,
John Wiegand,
Mordecai D. Lewis,
Joseph S. Walter, Jr.
James M. Linnard,
Isaac P. Morris.

On the Monthly Meetings.

Isaac Hays, M. D.
Alex. Dallas Bache,
Rufus Tyler,
Benjamin Reeves,
John C. Cresson,
A. M. Eastwick.

Managers of the Sinking Fund.

Samuel V. Merrick,
Frederick Fraley,
Alexander Ferguson.

Auditors.

Isaac B. Garrigues,
Joshua G. Harker.

(Extract from the minutes.)

M. W. Baldwin, *Chairman.*

William Hamilton, *Actuary.*

Committee on Science and the Arts.

Report on Mr. A. C. Jones' Spark Arrester.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, an apparatus for stopping the sparks from the flues of locomotive engines, invented by Mr. Alfred C. Jones, of Portsmouth, Virginia, REPORT:—

That it has for some time been considered a desideratum to devise a plan by which the sparks escaping from the chimney, or smoke pipe, of a locomotive engine, may be arrested, so as to ensure both the comfort of passengers, and the safety of goods, transported on rail-roads. The rapid extension of this mode of conveyance, is every day rendering this object of increased importance. Judging from the certificates of engineers and others, exhibited by Mr. Jones, it may be inferred that he has been more successful in relation to it, than preceding inventors.

The principal peculiarities of Mr. Jones' invention, are the following.

1. A projection, and funnel shaped opening, in the front part of the wire gauze, which surmounts the smoke pipe. This opening is for the purpose of admitting the external air to mix with the escaping smoke and steam, and is supposed to have the double effect of cooling and condensing the smoke and steam, so that it will not burn and destroy the wire gauze, and of pro-

ducing a horizontal, or backward, current of air, which throws the sparks into the receptacle hereafter described.

2. A peculiar shape in the wire gauze cap, extending a considerable distance backward, over or beyond the back of the top of the smoke pipe, which affords a space for the sparks to be thrown down into the receptacle hereafter described, the shape of the back part of the cap, or wire gauze, being such that the sparks do not strike it perpendicularly, but obliquely to its surface, and thus are thrown down, instead of passing through the apertures.

3. A receptacle for sparks, back of the top of the smoke pipe, and under the back part of the gauze cap, at the lower part of which receptacle is a pipe, extending downward into the smoke chamber at the end of the boiler, and below the part immediately connected with the boiler. Through this pipe, the sparks pass, and fall into the bottom of the smoke chamber. It is supposed by Mr. Jones, that the impetus of the steam, escaping from the engine, through the smoke pipe, produces a partial vacuum in the bottom of the smoke chamber, and causes a portion of air to rush down the said pipe, which makes the sparks the more readily descend, to a place where they are beyond the influence of the escaping current of smoke and steam, there to be consumed.

4. The gauze cap is made with hinge joints, so as to be thrown over backward, when the engine is not under way. This contrivance serves the double purpose of preventing the gauze from being clogged with lampblack, by the thick smoke escaping before the starting of the engine, and of facilitating the cleansing of the gauze, by a brush applied to its inner surface, where the smoke and lampblack condenses.

It is the opinion of the committee, that each of the foregoing features is productive of advantage. Hence, they are of opinion that Mr. Jones' apparatus is among the best that has been devised; an opinion which is confirmed by the respectable testimony which has been adduced.

There is a suitable apparatus for arresting the sparks when the engine is going backward, which it is deemed unnecessary here to describe.

By order of the committee.

January 14, 1836. William Hamilton, *Actuary.*

Report on Mr. L. V. Badger's Hot Air Forge.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, the Hot Air Forge, invented by Mr. L. V. Badger, of Portsmouth, New Hampshire, REPORT:—

That this forge consists of a hollow cast-iron hearth and back, divided by a number of air-tight partitions, so as to form, for the passage of the blast, one continuous square channel; this channel traverses both the back and the hearth. The air from the bellows, entering by the back, must flow between the partitions, doubling backwards and forwards, and passing the elbows between the back and hearth, until it reaches the tuyere, after nine changes in its direction. There are two tuyere holes, one at the corner of the back and hearth, the other considerably higher up in the back. The air from the lower tuyere flows out, through twenty small perforations, in a convex, hollow, false hearth, which is retained between two guides, and can be removed for the purpose of cleaning it.

The arrangement by which the air is made to traverse the hollow back and hearth, in order to cause it to enter the fire at an increased temperature, is neat and simple, but, in the opinion of the committee, ineffectual to produce the object. The amount of heated surface past which the air must flow, is so small, and the temperature itself of much of the back and hearth so low, as not to justify the anticipation of any material improvement in the temperature of the blast entering the fire. But any increase of temperature thus procured, will be more than counterbalanced, it is believed, by the important reduction in the force and velocity of the air, caused by the numerous turns and angles which it must surmount in reaching the tuyere. It is apprehended that the loss of blast from this source, is the radical defect of the proposed forge, while no commensurate gain can be exhibited from the augmentation of temperature.

There appears, also, to be an evil incident to the construction of the false hearth, namely, that the slag will be apt to choke up the perforations, more especially at each time that the hearth is permitted to chill.

By order of the committee.

February 11, 1836. William Hamilton, *Actuary.*

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN SEPTEMBER, 1835.

With Remarks and Exemplifications by the Editor.

1. For a *Lever Press;* Jonathan Payne, Russelville, Logan county, Kentucky, Sept. 9.

This lever press, it appears, has been the subject of an arbitration under the ninth section of the patent law of February, 1793, relating to interfering applications, which terminated in favour of the above named patentee. The construction of the press is pretty clearly made known in the specification, but no claim is there made to any part of it. It is intended for cotton, hay, tobacco, &c. &c. and is constructed as follows. A stout sill, from 30 to 50 feet in length has, rising from the middle of it, two upright pieces of timber 10 feet high, which serve to sustain a lever, or beam, between them of the same length with the sill, and measuring 12 by 18 inches. A stout pin, serving as a fulcrum passes through the upright cheek pieces, and through the beam. Either end of this beam may be drawn down by means of a rack and wheel work, the latter being sustained by the sill, and the former depending from the lever. A pinion, probably of 4 or 5 inches in diameter, turned by a winch, gears into a wheel of 7 feet diameter, having a pinion on its axle of 6 or 7 inches diameter, which acts upon the rack.

No directions are given for using this press, but as only one end of the beam can be employed at a time, the rack and gearing must at one end be used to raise, and at the other to depress the beam, between which and the sill the pressing must, necessarily, be effected.

2. For a *Churning and Washing Machine;* Thomas Ling, Winthrop, Kennebec county, Maine, September 9.

This is a swinging, or pendulum churn, which really has some novelty about it, and even in this fact alone, their is something cheering, as originality has long been a rare element in churns and washing machines.

The churn is a round tub suspended vertically within a frame, so that it can swing like a pendulum. A vertical shaft within the tub carries dashers, as is the case in many other churns. To cause the dashers to operate, the shaft projects above the tub, and a string, or cord, passed once or twice round it, the two ends of the string being attached to opposite sides of the frame; on vibrating the tub, the string operates like a drill bow, as will be readily perceived. The claim is to "the modification and combination of the swing or pendulum churn and the dasher, for churning and washing."

3. For a machine for *Washing Clothes and Fulling Cloths;* Orrin D. Wade, China, Genessee county, New York; an alien who has resided two years in the United States. September 9.

The clothes are to be put into a box, or trough, through the lid of which there passes a row of upright shafts having flat blocks of wood on their lower ends, which blocks nearly touch each other. A row of horizontal levers, hung upon fulcra, and acted upon by lifters on a revolving cylinder, cause the shafts and their blocks to rise alternately, whilst springs above the levers force them down. This constitutes the whole apparatus, to which no claim is made.

4. For a machine for *Purifying Potters' Clay;* Adam Weber, Womelsdorf, Berks county, Pennsylvania, September 9.

A cylinder is to be made of wood or metal, the bottom of which is to consist of a sieve through which the tempered clay is to be pressed by means of a piston fitting the cylinder, and forced down by a lever. The machine is claimed, generally, as operating upon the principle, and applied to the purpose indicated.

5. For a *Revolving Platform for Rail Road;* John Tustin, city of Philadelphia, September 9.

We believe that the mode of construction here proposed has not been made the subject of a patent, but recollect its being proposed, and an opinion given, that the plan would not be approved in practice.

A circular channel is to be made in the bed upon which the platform is to rest, which channel is to be adapted to the reception of round balls, like cannon balls. The revolving platform is to be similarly grooved on its lower side, and placed upon the bed with a sufficient number of balls to be nearly in contact with each other; as a safeguard, there is to be a centre pin.

With a heavy weight upon such a platform there will be much friction, the balls as they revolve passing over very unequal spaces on their touching parts; they will also be apt to overtake each each other, and thus increase the evil.

6. For a machine for *Shelling Corn;* Elijah Morse, Knox county, Tennessee, September 9.

A roller of cast iron is to revolve horizontally, and upon it there are to be rows of teeth which pass between others on the frame. The feeding, as we suppose, is to be effected by placing the ears upon a concave, hinged cover; whence they are to roll, or be forced, against the revolving shaft; a winch occupies one end of this shaft, and a fly wheel the other. The description is very imperfect, and the drawing, although well executed, must certainly show the teeth of the machine, and some other parts, incorrectly. The claim is to "the application of the roller, and the general construction of the whole machine."

7. For the *Application of Hydraulic Cement, &c.;* Obadiah Parker, city of New York, September 9.

This is an *application patent,* like most of, or nearly all, those obtained for the use of cement. By an application patent, we mean one which might be taken for applying a plaster of some approved salve to the head, another being taken for applying it to the shoulder, and others for all the various divisions and subdivisions of the superfices of the corporeal system. In the present instance are enumerated, "house and store cellars, vaults, small wood-cellars, vegetable cellars, cellars under side walks in cities, vaults in cemeteries, and vaults for milk, and garden cellars; the construction of walls, floors, and roofs of buildings, and walls for enclosure; the construction of locks and guards for canals; the construction of sinks for kitchens, and other purposes;" "which has not been known or used." Indeed! there is novelty in this information, and this, we are well convinced, is the only place in which we shall find it, although eighteen pages are occupied by the specification of these applications, and the claim thereto.

---

8. For *Making Artificial Stone, or Marble;* Obadiah Parker, city of New York, September 9.

Pulverized granite, or pulverized marble is to be brought to a proper consistence for moulding into the required form in combination with water lime. This constitutes the INVENTION.

---

9. For the *Formation of Artificial Stone and Marble for Architectural Purposes;* Obadiah Parker, city of New York, September 9.

We have again about a dozen pages devoted to the mode of forming various ornamental and useful articles, pavements, &c. &c. by modes analogous to those described in the preceding specifications, and having, consequently, the same claim to novelty, or rather to antiquity. Should the patentee think himself aggrieved by the foregoing remarks, a thing which we do not anticipate, we will offer him a reference to a gentleman in New York, who can tell him much more about the combinations of water lime, and the formation of artificial stone than he now knows; and will give him ample proof that our animadversions, or rather intimations, are founded in perfect truth.

---

10. For a *Water Wheel;* Jehiel W. Dart, and Stephen Wood, Truxton, Cortland county, New York, September 9.

This is a kind of re-action apparatus, in which two wheels differently constructed are to be placed one close above the other on the same vertical shaft; the first of these wheels has four floats which revolve in a circular drum through the side of which the water enters tangentically to the circle, and strikes the floats; after performing its labour there, it escapes through a centre hole in a horizontal partition, and enters the ordinary reaction wheel, passing through its curved channels, and escaping at its periphery.

The claim is to "the increase of power which is obtained in the above arrangement of the central discharger, or whirlpool wheel, and the reaction wheel." This is rather an inverted claim, being to the end instead of to the means, but this in the present case is a thing of little consequence.

---

11. For an improvement in the *Composition and Manufacture of Gum Elastic Cement;* Charles Goodyear, New Haven, Connecticut, September 9.

After dissolving the gum by means of spirits of turpentine, using two quarts of the spirits to one pound of the gum, magnesia is to be combined with it in the following way. One pound of magnesia is to be sifted through a fine sieve, into about two quarts of alcohol, with which it is to be well incorporated; a proper portion of the magnesia and alcohol is then to be mixed intimately with the dissolved gum, the quantity varying for different purposes, but being generally, in the proportion of six ounces of magnesia to the pound of gum. When applied between cloths, or to vessels to be filled with air, four ounces will suffice. When used to cover cloth on one side, eight ounces is preferred. If the whiter parts of the caoutchouc be taken, a solution will be obtained nearly colourless, and capable of receiving any desired tint.

We are not told that the magnesia is to be calcined, but being used as an absorbent and dryer, we suppose this to be case. This compound, it is said, dries very readily, is not tackey, and has the usual unpleasant odour corrected. The claim is to the application of magnesia.

We have been informed by a manufacturer that he has used magnesia with the solution, repeatedly; whether before it was used by the present patentee, or under such circumstances as to interfere with his patent, we do not know.

---

12. For a *Rotary Steam Engine;* John Bennock, Orono, Penobscot county, Maine, September 0.

A circular channel for a piston to revolve in is formed by bolting together two metallic rims, each of which contains one half of the channel turned perfectly true. These two parts are connected by bolts through flanches outside of the circular rim only, those on the inside not being in contact, but so far apart as to allow the flat rim of an interior wheel to be interposed between them; this wheel revolves on an axis passing through the centre of the circular channel, above mentioned, its periphery just reaching it, and having attached to it the revolving piston. Metal rings, inserted in grooves, and borne up by screws, are to be employed as packing against the sides of the interior wheel. A sliding valve, contained in a valve box, is withdrawn to allow the piston to pass, being acted upon by cams on the main shaft. There are, of course, proper openings for the introduction and escape of steam.

The machine is to be doubled, there being two circular cavities with their pistons, and other appendages, but having their valves in reversed directions, that the full action of the steam may always be upon one of them; the same main shaft is to carry both of the piston wheels. The claims made are to the using of two circular channels; the arrangement of the valves and pistons; the metal rings for packing, contained within grooves in the inner flanches, and the mode of pressing them up.

There is nothing new in this engine, either in the general construction, or in the particular points claimed. We could refer to engines essentially the same, in several published works treating on steam engines; but the worst feature of the affair is that neither of those which it resembles have answered in practice, whilst that now presented to us, does not appear to contain any redeeming point. It will be much more difficult to make than the ordinary engine, more difficult also to keep in order, and it will require considerably more steam to perform the same quantity of work.

---

13. For an improved *Platform Balance;* Jesse Marden, city of Baltimore, September 9.

The whole claim made in this case is to "the manner of constructing the platform so as to project downwards for the purposes specified." "Now my improvement consists in forming a downward projection from the side pieces of the platform, by means of rings, or links, and staples, from the inner prongs of the fulcrum, by which the platform hangs perfectly free, and will play in any direction, as if it hung on chains or ropes, always finding its centre of gravity."

14. For a mode of *Relieving the Shock in the Stopping of Rail Road Cars;* Charles Davenport, Cambridge, Middlesex county, Massachusetts, September 9.

Those who are well acquainted with the improvement in rail road cars, are aware that what has been called a buffing apparatus has been used to take off the shock occasioned by their coming into contact; the patent above named is obtained for a different mode of accomplishing this object, and also of affording a similar relief in starting. Instead of the continuous centre pole, by which the cars are connected, which receives the shock in stopping, and which takes the place of a perch in common carriages, there is a sliding box that projects out in the same manner, and is at its inner end connected to elliptical springs, like those used in carriages, placed transversely with the pole, and which are so fixed as to have the requisite play in either direction. Instead of these it is proposed to use spiral springs, fixed in the manner described in the specification. The claim is to the application of such springs.

15. For an improvement in the *Dead Spindle*, used in spinning cotton. Henry G. Davis, Northborough, Worcester county, Massachusetts, September 9.

The following quotation will afford a general idea of the nature of the proposed improvement.

"My design being to relieve the spindle from the friction of the fly whirl, and the tremulous motion incident thereto, I make the whirl, and consequently the flyers, play upon a tube, called the friction axis, through which the spindle passes, instead of playing upon the spindle itself; as is now done in the spinning frames in use, and not of my invention. To accomplish this the tubes must be stationary, and of sufficient strength to sustain and keep regular and steady the motion of the flyers. I have attained this end by one casting of iron, which constitutes the tube, and affords the means of fastening it to the spinning bar, so called in spinning frames, in such way that the spindle passes through it, and when the whirl of the flyers is brought to its place it fits to the tube, and turns upon it as a perpendicular axis, instead of turning upon the spindle; the tube being a shell interposed between the spindle and the whirl.

16. For a *Safety Hook, for detaching Tow Lines on Canals, &c.* Gotleib Schultz, city of Philadelphia.

This is merely a spring catch that may be opened by drawing upon a cord which disengages it, and allows the tow line to go clear. A similar contrivance it is proposed to affix to the swingle tree of a carriage. There is no claim, and but little room for one.

17. For an improvement in *Rail Way Cars;* Anthony Sherman, city of Philadelphia, September 9.

The fore and hind wheels are to have separate frames, but they are to be connected by jointed, transverse coupling rods, in order to enable them to turn easily, and to adapt themselves to the curvature of the road. The axles are each to be divided in the middle, to allow an independent motion to each wheel, the axles are also to be enclosed within a safety tube, running along it, which will support it in case of breaking. The transverse rods, and the divided axles, have so often come under our notice that we have nothing further to say about them. They however, form prominent parts of the present claim.

18. For *Eradicating Corns;* William Davis, Williamsburg, James City county, Virginia, September 9.

Diluted nitric acid is to be applied to the corns to soften them, and they are to be rubbed down with pummice stone; that is all. Nitric acid has often been applied to corns, and they have been rubbed down by files, or by emery sticks, made for the purpose; we apprehend, therefore, that those who have corns may still use the indicated means of cure.

19. For an improvement in the *Coffee and Corn Mill;* Elijah Morse, and Caleb Putnam, Knoxville, Tennessee, September 9.

Nominal *improvements* are so easily made that it requires no talent whatever to be the author of them, and such is that which forms the subject of the present patent. The mill in which the pretended improvement is made, is the common cast iron mill with a conical shell and nut, in its unaltered state, excepting only that the patentees "claim as their own invention, and not previously known in the above machine, that the furrows in their mill run straight through, and not spiral, as in all other mills." It does not require two grains of mechanical knowledge to enable a person to decide that this change deteriorates instead of improves the mill; nor is it necessary to have dipped deeply into the logic of Aristotle, or of Watts, to arrive at the conclusion that it requires one and one to make two, yet in the case before us we are to admit that the inventive genius of two individuals might be put into requisition to devise one set of straight furrows.

20. For a *Bedstead for the Sick;* Nathaniel Richardson, Boston, Massachusetts, September 9.

It would be a sheer waste of time to detain our readers with a particular description of this contrivance, which is intended only to elevate the upper or lower half of the frame and sacking bottom of a bedstead, by means of a windlass and cord. The mode of doing it is no improvement upon others, and the end obtained does not differ in the slightest degree from that often accomplished, and attainable by any mechanic in his own way. "The combination and arrangement of the parts" forms the stereotyped claim.

21. For a *Saw Set;* Lewis Barmore, Hanover, Chataque county, New York, September 9.

The principal part of the specification of this patent consists in the exact measurement of the respective parts, and other matters of no moment. The setting is to be effected by placing the teeth of the saw upon a small anvil, and striking with a hammer, the handle of which passes through a shaft turning on gudgeons in uprights, the hammer being raised by the revolution of a piece of wire, bent crank fashion. The saw is to be sustained upon a rest, and the points of the teeth are to bear against a metallic roller. The claims are to "the application of the crank to the hammer handle; the rollers to guide the teeth of the saw across the anvil, and the rest, block, and gauge, and their advantages," which latter appear to us to be few in number, as there are many saw sets in the Patent office which we should prefer to this last improvement.

---

22. For *Stamps for Post Offices;* Benjamin Chambers, city of Washington, September 9.

These stamps are to have a fillet round the outer edge of the face, which fillet is cut, or left, on the solid metal. It surrounds, and is intended to protect, the letters which designate the office. The claim made is "the manner in which I construct the ledge, or projection on the outside circumference of the face of the block, being cut out in relief from the solid body of the cylindrical block."

We have seen such fillets, or ledges, cut out of solid blocks both of wood and metal, in use long before the obtaining of this patent.

---

23. For *Supplying and Regulating the Draught of Air to Fire Places;* Robert Mayo, city of Washington, September 9.

Pipes, or tubes, of tin, or other material, which may be from one and a half to three inches in diameter, are to lead from the lower part of a building, up the outer walls, their upper ends opening under the grate or fire place. Such pipes may be added to buildings already erected; but in the erection of new ones it is proposed to form these ascending air channels within the thickness of the walls, their lower ends opening to the external air, and their inner to the fire place. Valves to regulate the quantity of air admitted, may be constructed of any suitable form.

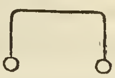
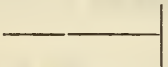
The claims made are "*First.* The arrangement, combination of parts, and adaptation of the air pipes, or tubes, to ascend the outer walls or chimneys of buildings, or apartments, and penetrate the same contiguous to fire places. *Second.* I claim the construction of air channels or flues in the masonry of chimneys, or the walls of buildings, to ascend from a lower stratum of atmosphere and terminate near to, or in, the fire places."

With the exception of extending the tubes to the lower part of a building, it will not be pretended that there is any novelty in this contrivance, the practice of admitting air from without to feed fires, being old and common; but even the ascending tubes themselves are not new, they having been frequently recommended and applied to the supply of fires for the purpose of ventilating cellars, and other lower apartments; it may be said, however, in the present case, that this is not their object, that object being merely the supply of the fire; without inquiring into the validity of this allegation, it is proper to ask what are the advantages of these descending pipes, and we believe that this is a question which cannot be satisfactorily answered. The patentee says that we shall "thereby create a constant current through the tube, or pipe, of a strength proportionate to the height of the pipe, or the greater weight of the medium of atmosphere at the lower extremity, or inlet, than that at its upper extremity, or outlet; which takes place upon the same principle of pneumatic or atmospheric pressure, which forces water in a tube, or well, to rise to the height indicated by the known weight of the atmosphere: and this principle is equally applicable, of course, to the air channels, or flues, constructed in the masonry."

The foregoing may pass with the illiterate for good reasoning, but it is altogether false and unfounded. The pressure at the opening of the tube within the room will not be altered by the extra height of the atmosphere above the lower opening, the column within the tube being a perfect balance to this; the whole trouble and expense of the tubes may, therefore, be saved, together with the cost of a patent right to do that which is in itself altogether useless.

---

24. For a *Saw Mill Gauge;* William A. Needham, Brimfield, Hampden county, Massachusetts, September 9.

This appears to be a very imperfect affair, when compared with many other devices for setting or gauging saw logs. A bar of iron is to be bent twice at right angles, thus,  its ends being attached by hinge joints to the head block; upon the top bar there is to be a slide, which may be secured by screws, and which is to be graduated into inches and parts. The end of this bar towards the log has a piece attached to it, thus,  which piece is to bear against the log, and to keep it upright. The claim is to "the arrangement of the parts described, to cause a log to be sawed into any required thickness marked upon the graduated edge of the slide."

---

25. For a *Cooking Stove;* John Whiting, of Boston, and John Mears, of Dorchester, Norfolk county, Massachusetts, September 9.

The main, or only, novelty in this cooking stove, consists, like that of most others, in the particular arrangement of the respective parts, as devised by the patentees. The claim is to "the construction of such stoves, as aforesaid, and the several parts thereof, not separately, but in combination for the purposes aforesaid; and also the construction of stoves so that the hot air may pass first over, then down by the side of, and then under, the oven, and then between the oven, and the furnace, in manner aforesaid, and for purposes aforesaid. The construction of the oven and furnace may be somewhat varied, at discretion, and the side door for roasting may be dispensed with, if thought advisable; but the construction above mentioned is deemed most convenient, in all cases." We cannot attempt a description of the particular arrangement, which is well shown in the drawing, referred to throughout in the specification.

---

26. For a *Coopers' Stock, Howel, and Croes;* Melancthon Sutton, Penfield, Monroe county, New York, September 9.

In this invention, the work heretofore requiring the use of two instruments, is to be performed by one. A very particular description of the tool is furnished, and explained by reference to the drawings, which show the peculiar form given to the cutting iron. The claim is to "the peculiar construction of the edge and angles of the cutting instrument, by which it supersedes the necessity of a separate howeling iron, and performs the work in less time. The moulding of the faced edge of the stock face, to conform to the cutting angles of said instrument; and the sliding gauge, as described, and delineated in the drawing."

---

27. For a *Washing Machine;* James Lombard, Readfield, Kennebec county, Maine, September 9.

The trough of this machine is a concave semi-cylinder, closed at the ends, and fluted along the semicircular part. The *rubber*, which is to act upon the clothes, is also a semi-cylinder, which passes into the trough, and is suspended by an axis at, or near, its centre. This rubber is either fluted, or covered with fluted rollers, passing from end to end on its curved surface. It is so hung, by means of a strap, or chain, as that it may recede from the trough, when too great a quantity of clothes may be between them, and also to admit of its continued pressure upon them. The rubber is to be made to vibrate by means of a handle. The claims are to "the form and application of the rubber, or interior cylinder. The mode of suspending and operating the rubber, and the application of the strap, or chain, whereby the pressure is regulated, and the rubber allowed to yield."

---

28. For an improvement in the *Saw Mill;* Linus Yale, Utica, Oneida county, New York, September 11.

Upon the head block there is to be a plate of cast-iron, about three feet in length, which slides between grooves, or ledges, on a cast-iron bed, that is fastened to the block. A bar of iron, which may be an inch and a half square, is to be placed upon the slide, along that edge of it which is farthest from the log; by means of pins and holes, properly constructed, it may be placed firmly upon the slide, with either of its sides uppermost, and these four sides are divided and notched to suit four different thicknesses of stuff, the notches serving for a setting pall to fall into, which is acted on by a lever, which lever, when raised by the hand, sets the log. A similar slide, and its appurtenances, are affixed to the tail block, but here it is rendered self-setting by an apparatus, not very clearly described, and for the study of which we cannot afford much time. A particular construction of the dog is also described, but so obscurely that we know little, or nothing, about it, although it forms one of the matters claimed. Neither the use of the lever, nor of the slide containing the dog and bar, is claimed, but, "*first.* The dogs swinging upon a vertical shaft, as described. *Second.* The construction and use of the notched bar, as set forth. *Third.* The construction and use of the pointed, or setting, arm, as set forth. *Fourth.* The manner in which I construct the inclined plane, as set forth. *Fifth.* The manner of casting the plates and slides together."

The third and fourth claims refer to the self-setting part; the fifth at least, it might have been better to have omitted.

---

29. For a *Machine for Breaking and Cultivating Sward Ground;* Guy Gray, Industry, Somerset county, Maine, September 18.

A square frame is made to contain a roller, like that used for rolling ground, and a tongue is attached to the frame to draw it by. The roller, as described, is four feet long, and is set with teeth in twelve rows, containing, alternately, five and six in a row; the teeth, which are pointed, are seven inches long, but curved so as not to project more than six inches from the roller. There are teeth, also, on the back rail of the frame, so set as to allow the roller to pass between them. The patentee says, that when this is "drawn over the closest sward land, it breaks it more thoroughly than any other machine known to him, so that the ground may be afterwards ploughed with less than half the strength of team otherwise required, whilst it is left in a much better state for cultivation."

There is not any claim made; the whole must, therefore, be considered as new, or the patent cannot be sustained.

30. For a *Loom for Weaving the Cloth for Stocks;* Conrad Kile, Erie, Erie county, Pennsylvania, September 18.

The frame, warp, and cloth beams, &c., are placed in the usual manner, the improvement consisting "in the form, or mode, of constructing them, and is grounded on the following requisite, to make the stock set closely to the neck, and accommodate itself to the shape, viz: that the selvage should be much longer than the centre of the cloth, so that, while the centre of the stock fits the neck closely, the selvage, both at top and bottom, is so loose as to yield easily to the motion of the chin, after the manner generally effected by inserting pieces of an angular shape around the top and bottom. This object of increasing the length of the selvage, I effect by means of the shape I give the beams above mentioned on their circumference, for, instead of their being straight from one end to the other, I form them concave, so proportioned that the girth of the centre of the beam is about one-third less than that of each end."

The particular arrangements necessary, or adopted, in completing the plan, are described at considerable length, and a claim is made to "the concave shape given to all the beams, and to the reed; to the manner of making the lower semicircular bar of the reed; and the manner of joining the uprights of the reed, by means of arms, to the axis of the straining beam."

---

31. For a *Tailors' Measuring Apparatus;* John S. Rockafellow, Flemington, Huntingdon county, New Jersey, September 18.

The claim made is to "an improvement on D. Williams' patent, by the construction of a scale equal in length to the entire circumference of the human body, and having the tape of an entire length, and the movable slide and upright to secure a correct measurement for the cutting of garments."

---

32. For an improvement in *Beds, Cots, and Hammocks;* William I, and Alfred E. Lyman, Easthampton, Hampshire county, Massachusetts, September 18.

The specification of this patent is more sentimental in its commendatory, than clear in its descriptive, part. It seems, however, that conical, spiral springs of wire, are to be interposed between the rails of a bedstead, and a frame above it, over which a covering of cloth, leather, &c., is to be stretched. For cots, &c., the fixtures must be adapted to them. In warm weather, a sheet only, and, at other seasons, a covering adapted thereto, will, we are told, "render this bed a great comfort to the sick, the weary, and the aged, and a great exciter to 'nature's sweet restorer, balmy sleep.' By the action and reaction of the springs, support is afforded to the inequalities of the human frame in equal measures, so that muscular action is in a sense suspended, and a quiet repose given to the whole system."

The patentees "claim as their own invention and improvement, the application of metallic conical spiral springs, as a support in the fabrication of beds, cots, or hammocks, in the manner herein described."

How many patents for the application of spiral springs we have seen recorded, we cannot tell, but they are not few. We, however, recollect one from the same county with the foregoing, dated August 25th, 1831, and noticed at p. 128, vol. ix., which, uninviting as we thought it, appeared to offer more comfort than the one under consideration.

33. For a *Plough for Cultivating Corn and Potatoes;* Peter Stahl, and John Diffenbacher, Turbut township, Northumberland county, Pennsylvania, September 18.

This instrument is made in the form of what is commonly called a cultivator, and is furnished with six shares, affixed to standards twenty inches in length, for the purpose of mounting the beams high up above the ground. For the particular form of the shares, the model is, incorrectly, referred to. The following is the claim.

"The shares, or mould-boards, which are each cast in one piece, and forming a coulter, share, and mould-board. The high standards, which carry the plough beams so far above the corn, or potatoes, as not to break it down so long as it needs cultivating. The placing these in such a manner as to plough, or cultivate, both sides of a single row of corn, or potatoes, at one and the same time of going over the same."

---

34. For a *Wool and Flax Brusher;* William W. Calvert, Lowell, Middlesex county, Massachusetts, September 18.

"The principle by which this is distinguished from all other inventions, is the brushing of wool, or flax, by a bristle, or wire, brush, *into* teeth set on a cylinder, or otherwise, as may be convenient. And also the combination of the parts of the universal swiper, for which I claim a patent." The object in view is the separating the long and short fibres from each other. The machine is well represented in the drawings, and clearly described; without the former, however, we should fail in an attempt at the latter. We think that much ingenuity and skill are manifested in the mode adopted for carrying out the conceptions of the patentee, but we are unable to offer any opinion of the probable success of the plan, as it is, in the present instance especially, a question of experience.

---

35. For *Printing and Dying Woolen Cloth;* William Duncan, Bellville, Essex county, New Jersey; an alien, who has resided two years in the United States; September 18.

If the person who has obtained this patent was employed in the woolen business in Great Britain, before his emigration to this country, we should not be able, with the utmost stretch of charity, to believe that he was unacquainted with the fact that the process he describes was generally known, and frequently used there. That we may not err in giving the process for which he obtains a patent, we will quote the precise words of the patentee himself.

"In order to preserve the native, or any other colour, for the purpose of ornaments in the printed article, from receiving the general, or ground colouring, which is given to it in dying the same, the ornamental figures are to be tied in knots, in such manner and form as the artist may think proper, by winding round them hemp, or thread, of any description, so as to resist the general colouring matter from penetrating into those figures."

We have known the process for more than half a century; among our earliest recollections are woolen garters, with mottoes on them, made by pressing against the strip of cloth, a mould, with letters cut on it, and thereby protecting the parts pressed in the process of dying. At the ends of these mottoes, and at other parts, were the flower-like ornaments made, in the way above described. But, apart from this, there are few dealers in cloth, anywhere, who are not well acquainted with this process, as it is common as a test mark on the corners of pieces of cloth, to show that the colour given has been produced at two operations. Who has not observed these stars, or rosettes?

---

36. For a *Machine for Planting Cotton;* Robert S. Goodman, Ballsville, Powhatan county, Virginia, September 18.

This is one of those classes of machines, the individuals of which can scarcely fail of exhibiting a strong resemblance to each other. They run upon wheels, which are fixed on a revolving shaft, or axle; they carry a hopper, into which the seed is put, and which falls through an aperture regulated by the revolving axle. There is a share in front of the machine, to open a furrow, and a scraper behind, to cover the seed. These are the general elements, which are common to all, and are common property; what is left, therefore, to ingenuity, or fancy, is to devise those minor arrangements upon which the more or less perfect action of the machine is dependent, and which have usually too little of originality, or skill, to render it worth while to follow them out, and such we think the case in the present instance. The claims are to "the manner of using the wheel at the perforation at the bottom of the hopper. The revolving shaft, with the pin, or pins, and conductors, attached to it, to be set in motion in the manner described."

---

37. For a *Machine for Shelling Corn;* James S. Harris, Poultney, Rutland county, Vermont, September 18.

We apprehend that this will prove to be one of the least valuable of all the corn shelling machines, from its being inconvenient and laborious to operate with, whilst it will not be recommended by its efficiency. It consists of a fixed rubbing board, set with teeth, or otherwise furnished with projecting points, and a movable rubbing board, to be worked up and down by a lever, which is moved by the right, whilst the feeding is to be performed by the left hand. No other provisions are spoken of, nor is any claim made.

---

38. For a machine for *Setting Boxes in Hubs;* Edward Badlam, Jr., Chester, Windsor county, Vermont, September 18.

The hub is to be fixed on a frame, being adjusted by screws, so that it shall be properly centred. A shaft, fitted into collars, and turned by a winch, carries the cutters which are to let in the box, which cutters are made adjustable, in order to adapt them to the required size. The claim is to "the arrangement of the slides, dies, screws, and scales, for the purpose of adapting the machine to all sizes of hubs, and to enable the workman to set the hub in the centre of the frame."

There are several patented machines for the same purpose, arranged in a very similar way, and possessing all the virtues of the foregoing.

---

39. For *Propelling Time-pieces by the Expansion and Contraction of Atmospheric Air;* Andrew Morse, Jr., Bloomfield, Somerset county, Maine, September 18.

How many such machines as that here patented have been made, it would be impossible to tell, as they are calculated merely to satisfy the curiosity of their contrivers, and destined to final repose in the lumber room. An instrument very similar to that before us, is noticed at p. 126 , vol. v. of this Journal, and some remarks upon the application of the principle of expansion and contraction by change of temperature, may be found in vol. 2. p. 326. The air which is to operate, is to be contained in a cylindrical vessel, within which there is to be a second cylinder, open at top, but closed at the bottom by a sheet of India rubber, or other flexible, air-tight material. As the air alters in its dimension by heat, it is to raise and lower a piston, working loosely in the inner cylinder, and resting on the India rubber; a rod from this piston turns ratchet wheels, and winds the clock. The claim is to "the before described machine for winding up time-pieces, with the arrangement and adaptation of its several parts." Were the thing of any value, it might be a matter for regret that the description and claim were not less vulnerable than they are; but we think them as good as the invention, and do not anticipate the validity of the contrivance being made a question in court.

---

40. For a *Machine for Dressing Hoops;* B. Kimball, A. Pevey, and F. Spalding, Petersborough, Hillsborough county, New Hampshire, September 18.

A wheel furnished with cutters on its face, near to its periphery, is made to revolve by means of a mandrel, like that of a lathe. A gauge stands in front of the cutters, having a roller, against which the outside of the split bears; this gauge is capable of being made to recede, by means of a lever, so as to allow the necessary increase of thickness in case of knots, &c. The following is the claim. After stating the various modes of arrangement which may be adopted, the patentees say: "We do not, therefore, claim the individual parts of this machine, as they have all been used under other combinations, and for various other purposes; but what we do claim as our invention, is the construction of an instrument for dressing hoops, made and operating, substantially, in the manner herein set forth; having a revolving cutter wheel, a shifting gauge, and the auxiliary appendages which give to it that character by which it is distinguished from other machines for the same purpose."

This machine has, we are informed, been found of very great value in its application to the purpose for which it was constructed.

---

41. For a *Cradling and Mowing Machine;* Edward Badlam, Jr., Chester, Windsor county, Vermont, September 18.

By means of a face cog wheel on the inside of one of the wheels upon which the machine runs, motion is given to a horizontal shaft, the opposite end of which gears into a bevilled pinion on a vertical shaft, which sustains scythes, revolving horizontally. Small wheels on the underside of the fixtures of these scythes, run upon the ground, and serve to raise them over knolls, whilst springs above them keep them in their places; the grass, or grain, is received upon fingers, which conduct to a rack.

The claim is to "the springs, with the fixtures for enabling the scythes to pass over small knolls; the fingers and the rack, for the purpose of catching and laying the grass and grain, after being cut by the scythes."

---

42. For machinery for *Cutting and Collecting the Heads of Grain, and Grasses;* Jacob Peck, and Daniel Ashmore, Jefferson county, Tennessee, September 18.

This machine is intended to be driven forward like a wheelbarrow, when grass seeds are to be collected, but for collecting the heads of grain, horses are to be employed to *drive* the apparatus, which, in its general form, resembles a cart. The machine must be mounted upon wheels of such height as will suit the grain, or grass, the seeds of which are to be collected. The heads, as the machine advances, are to be received between a row of lancet shaped knives, flat on the top, and beviled to a sharp edge from below. Fingers of wood, or of metal, may also project forward, the better to guide the heads to the knives. Above the knives there is a kind of revolving reel, set in motion by bands and whirls, connected with the running wheels of the carriage; this reel, or open cylinder, carries knives, which come nearly into contact with the row of fixed knives before spoken of, which cut off the heads of the grain, or the grass. There are various appendages to, and modifications of, this machine, described in the specification, which we cannot wait to notice.

"What we claim as our invention, are the lanceolate knives, or, in the stead of them, the series of fingers, with other knives, to steady the grain in cutting. The revolving wheel, with strikers, knives, and canvass. The collecting hand with its wheels, crank, lever, rest, and adjustment. The pulleys and band to drive the revolving wheel. The propelling power behind. The principle of the governer of the rudder to give direction to the machine; and the application of the whole to the use and purpose of cutting and collecting the heads of grain, leaving the straw on the ground, and in like manner saving clover and other grass seed."

We believe that it will be proved upon investigation that this claim embraces too many particulars, and thus includes things which have been before well known and employed. Rows of lanceolate knives are not new; the propelling from behind in grass and grain machines is not new; the driving a wheel by a band and whirls is not by any means a fit subject for a claim; yet there is certainly enough in the machine upon which to have procured a valid patent.

---

43. For an improvement in the manner of *Dressing Mill Stones;* David B. Napier, Casey county, Kentucky, September 18.

In a stone four feet in diameter, a circle of eight inches is to be described at the centre, and eight leading furrows are laid off, each of which forms a tangent to said circle, which gives the leading furrows four inches draught. Two short furrows are laid out between each of the leading furrows, the strip being still laid to the periphery of the draught circle; these latter terminate 1½ inch before they reach the leading furrows. The leading furrows are to be half an inch deep, and from one to one and three-fourths of an inch wide. The short furrows are one inch wide.

" The only right I claim is in graduating the long or leading furrows so as to receive the feed freely; and the draught of the short furrows so as to make them pass over each other at an angle of about 25 or 30 degrees."

---

44. For an improvement in the *Saw Mill Carriage;* Samuel Phelps, Mount Morris, Livingston county, New York, September 18.

This patent is taken for a very simple, yet, we think, a very efficacious and good mode of running back a saw mill carriage. The ways upon which it runs are to be furnished with friction rollers, and to be so inclined that the carriage will run back by its own gravity. An elevation of three or four inches in twenty feet is found to be sufficient for this purpose, when the friction rollers are well made. The claim is to the mode of running back a saw mill carriage.

---

45. For *Propelling Boats;* John L. Smith, Charleston, South Carolina, September 18.

This invention will not make a revolution in the art of propelling boats. The propeller is to be a screw, or some equivalent instrument; a cavity to receive this screw, is to be made by giving to the boat the form of a twin boat from about midships to the stern; the fore part, to the bow, being in the ordinary shape. The patentee calculates that this cavtiy will be filled with nearly still water, and that he will thence derive very great advantages, as will be seen by the following claim.

"What I claim as my own invention, and not heretofore used, in the above described improvement, is the peculiar devise by which I obtain the management of the body of comparatively still water, and the application of my propelling power therein, as has been already stated; or in other words, the manner of propelling boats or other bodies by means of screws, or other propellers, working in the dead or still water, obtained by such a construction of the vessel as shall leave a cavity, or cavities, or hollow space therein, open only to such a distance, and at such a point, or points, as may be deemed most advisable the screw, or other propellers, should be placed in."

The screw has been tried often enough to prove that it is one of the most inefficient propelling instruments which have been essayed, and it may be safely predicted that the cavity in which the present patentee proposes to place it will not aid in redeeming its character.

---

46. For *Manufacturing Glue;* Jonathan Morgan, Portland, Cumberland county, Maine, September 18.

This patent is taken for improvements in the apparatus employed in making glue, and in the mode of using it; the specification, describing these improvements, is one of very great length; and even the claims alone are too extensive for us to present to our readers. They relate to the construction of the boiler, with the application of steam to it. The construction of the netting frames on which the stock is suspended; a peculiar manner of making the pans employed; and also a washer wheel for cleansing the stock.

---

47. For a *Cooking Stove;* Ezekiel Daball, North Canaan, Litchfield county, Connecticut, September 26.

The claims to this stove refer to the particular manner in which the parts of it are arranged, and contain all we think it necessary to give; they are the following.

"Those parts of this stove which I claim as my own invention are the following: the fixed horizontal plate over the fire, containing two orifices. corresponding in size and position to the two orifices in the top plate, together with the two swing dampers over that plate; another damper which shuts the space between said fixed plate and the oven; and also the two swing dampers between the top plates of the stove and the top plate of the oven; also the rim and two movable plates forming the top of the stove. and the invention described for changing the place of the movable plates; also the smaller pipe open at both ends, passing through the common stove pipe, and the ventilation for carrying off the steam. These things I claim as my invention, and for them only do I claim letters patent of the United States."

48. For *Cleansing Clover and other Grass Seeds;* Hiram Holt, Weld, Oxford county, Maine, September 27.

A cylinder, which may be two feet long, and the same in diameter, is to be covered with sheet iron, pierced so as to constitute a grater. Two concave shells, with like surfaces, are to be placed one on each side of this cylinder, leaving an opening at top for feeding, and at bottom for the escape of the seed. The cylinder, whose axis is horizontal, is to be made to vibrate backward and forward, to rub out the seed. The concaves are adjustable by screws. The claim is to this particular action of the cylinder, furnished with a concave on each side.

49. For a *Machine for Turning Boots;* Sherburn C. Blodget, and Henry Boynton, Rowley, Essex county, Massachusetts, September 26.

This machine is for turning boot-legs, and the patentees claim the whole arrangement of it, which, they say, effects, with great facility and ease, what has hitherto been a troublesome operation.

A tube of tin, eight inches long, and four in diameter, is to be placed so as to stand vertically upon a suitable frame. The top and bottom of the tube are to be left open, the top having its edge smoothly turned over a wire, and the bottom being firmly attached to a perforated board, forming the top of the frame. The boot to be turned is placed over the tube, and two hooks, attached to a rod which passes up through the tube, are made to lay hold of the straps of the boot; the lower end of this rod is formed like a stirrup, and on pressing this down by the foot, the boot is drawn through the tube, and turned, the hands of the operator aiding in the process.

50. For a *Cooking Stove;* Putnam Page, Sangerfield, Oneida county, New York, (assignee of D. Gage,) September 26.

It is stated in the specification that this patent is obtained for an improvement on what is called the *Bool* stove; and the said improvement consists mainly, if not entirely, in changing the dimensions of the fireplace, the oven, and certain other parts. There is not any thing which can properly be called a claim, but we are told that "the entire object of the improvement is, first, to forward the speed and conveniency in cooking and washing, and other business; secondly, to save a great proportion of the fuel usually taken and required in other stoves; thirdly, its durability, each piece being so shaped and constructed as not to be broken or cracked by the use of the fire."

51. For a *Forge Back;* James Knickerbacker, Laporte, Laporte county, Indiana, September 26.

This forge back is to be of cast-iron, with a cast-iron box at the back of it, to receive the air from the bellows; there are to be two or more tuyeres, or tew irons, to admit air into the fire, and these are to be furnished with valves, or stoppers, attached to rods which pass through the back of the box, so that they may be opened or closed at pleasure. The advantages which result from the use of a box are descanted upon as though this were a novelty, whilst the only new feature in this contrivance is the using more than one tuyere, a thing of very doubtful utility in a common smiths' forge. The claim is to "the before described apparatus, and mode of regulating the blast of forges; but I make no claim to making the forge back and bottom of cast-iron." This claim is too broad, as the *apparatus*, with the exception named, is old.

---

52. For an *Alarm for Steam Boilers;* Thomas Odiorne, Malden, Middlesex county, Massachusetts, September 26.

The specification says, "this is done by means of a tube extending from without to the inside of the boiler, through a fixed standard erect within, and through the sides or ends of said boiler, as the case may require, to which standard is attached a lever valve, closed by a spring, and opened by a sliding buoy, which as it settles down upon the falling surface of the water, presses upon the lever, opening the valve, when the escaping steam gives the alarm. This may be done by a racket wheel, by a buzz, by a bell, or by a trumpet, &c. The whole of this apparatus as applied and exemplified in my draught and *model*, I claim."

As regards the *model*, we do not refer to it for our own information, as it makes no part of the patent; the description is very general, and the drawing does not supply its deficiencies. The idea of giving an alarm by the subsidence of the water is a very familiar one; the mode proposed is not, we think, founded upon correct principles, as, in practice, a buoy that is to rise and fall, peaceably and quietly in the boiler, will not always do so.

---

53. For an improvement in the *Chimney and Fire Place;* Moses Perin, Connersville, Fayette county, Indiana, September 26.

This appears to us to be a very strange kind of contrivance, and one which few persons are likely to adopt; it is not very clearly described, but sufficiently so to show that there is to be a kind of blower, or register, to regulate the draught; and, in front of the fire place, two or more sliding doors to close it up either entirely, or partially. "The combination of the parts, and the mode of putting them together," constitute the claim.

---

54. For an improvement in the *Grist Mill;* Owen Moses, Malone, Franklin county, New York, September 26.

The stones in this mill are to run vertically, and are both of them to revolve, but in opposite directions. The shaft of one stone is to be a hollow tube, through which that of the other passes, and a horizontal crown wheel is to mash into wheels on each of these shafts. The feeding is to be through the eye of one of the stones. There is no claim, and if it is supposed that the revolving of both stones, or the mode of gearing to effect this, is new; a little inquiry would manifest the erroneousness of such an opinion.

---

55. For a *Spiral Cone Blower;* Benjamin Brundred, Oldham, Bergen county, New Jersey, September 26.

This is a revolving blower, acting upon the principle, but differing in form from, the ordinary winged blower. The casing is to be conical, with a shaft passing through its axis, upon which shaft there are to be wings set spirally. The air is to be admitted at the smaller, truncated, end of the cone, and is to escape through a tube, or tubes, at its lower end. The patentee tells us that ' the great advantage of the spiral blower, over all other blowing machines now in use, consists in its spiral or screw like wings, revolving with great velocity inside of the casing, and accurately set and curved so as to draw in and force forward the air."

No directions are given respecting the accurate setting and curving of the wings, and in the specification it is indicated that they may be straight. The thing may be good, but we do not see the source of its excellence. There is no claim made.

56. For a *Washing Machine*; John J. and Ebenezer C. Milliken, Winthrop, Kennebec county, Maine, September 26.

A trough is to be made in which there are to be two sets of vibrating stocks, of the ordinary form; a double crank shaft, the cranks at right angles with each other, is to work the levers by which the stocks are suspended; the cranks pass through slots in these levers, and are furnished with friction rollers, thus dispensing with pit-men, but by a much worse contrivance.

Claim.—"The application of a crank directly to the arms of the stock, in such a manner that one stock only shall press at a time. The application of friction rollers to the crank, as above described, &c.

57. For an improvement in the *Composition of Mead;* Theodore T. Kimball, and Adner H. White, Dedham, Norfolk county, Massachuetts, September 26.

One pint of sugar-house molasses, two table spoonsfull of wheat flour, one pint of new milk, and one pint of yeast, are to be put into a six gallon cask; air is then to be forced in by a force pump, and the cask stopped for twenty-four hours. At the expiration of this time, two gallons of boiling water, mixed with five pints of honey, or five pounds of loaf sugar, one third of an ounce of ginger, half an ounce of allspice; two ounces of essence of sassafras, a tea spoonful of essence of rose, and half an ounce of isinglass, are added, and the cask filled up with cold water. It is then to be corked up, and allowed to remain for twelve hours, and it is ready for use.

The claim is to "the use and application of the honey, or loaf sugar, the sassafras, the rose, and the isinglass; and the proportions of the last described composition."

58. For *Supplying Air to Forges;* Seth W. Watson, and Cloud Robinson, Ashtabula, Ashtabula county, Ohio, September 26.

This contrivance is in part like that described at No. 51; that is the tuyeres are to be supplied with stoppers in the same way; but instead of one box only, there are to be two, connected by a tube, so that the air blown into one may pass freely into the other; the fire is to be between these two boxes, each having its blow pipe, or tuyere. The claim is to "the carrying the air to the second from the first box, so as to let the air to the fire in counter currents, and in opposite directions, from the same bellows."

59. For an improvement in the *Art of Finance;* John Golder, city of Philadelphia, September 26. (See specification.)

60. For *Weaving Silk by the Power Loom;* Gamaliel Gay, Poughkeepsie, Dutchess county, New York, September 26.

This patent is obtained for "an improvement in the art of manufacturing silk;" which improvement consists in performing the operation of weaving in the power loom, to which purpose, it is said, that instrument has not heretofore been applied. The machinery is not claimed, as it is employed in the usual form, and only adapted to the weaving of silk.

A question has arisen whether such a patent is valid, and for its support reliance is placed upon that provision of the patent law allowing a patent for "a new improvement on any art." If silk can be woven upon the power loom with much greater economy than by any method previously adopted, it is contended that this constitutes such an improvement.

61. For *Condensed or Concentrated Writing Ink;* John D. Myers, city of New York, September 26.

The claim made is to "the making of inks into a solid substance capable of being moulded into cakes, rolls, balls, wafers, pills; or the above substance reduced to a powder, or any other shape that may be desired, free from sediment, and fit for instant use by the application of warm or cold water."

The recipe given is very imperfect, mentioning only one of the ingredients of ink, and is as follows. "A watery extract is made from nut galls, &c. or any other matter suited for making black or coloured inks; thus forming a common writing ink. The whole is then filtered and carefully evaporated, by steam or other heat." Qu. May a person add water to dried up ink?

62. For *Turning Short Curves on Rail Roads;* James Stimpson, Civil Engineer, Baltimore, Maryland. First patented August 23d, 1831. Patent surrendered and reissued, September 26. (See specification.)

63. For the *Formation of Rail Road Plates for turning Curves;* James Stimpson, Civil Engineer, Baltimore, Maryland. First patented August 23d, 1831. Surrendered and reissued, September 26.

This patent might have merged in the foregoing, the specification of which we have given, but as the subject was divided into two parts originally, it has been thought best not to incorporate them in the reissue. The specification before us enters very much into details, and is too long for our pages, and as it cannot very well be epitomized, we shall give the claim only.

"What I claim as my inventions or improvements are, the employment of plates, or rails, either of cast or wrought iron, constructed upon the principle, or in the manner described, having narrow grooves for the flanches to run in, by which they are perfectly adapted to the unobstructed passing of all kinds of carriages used in streets, over them. The running of the peripheries of the flanches, or of the cone, or rise on the tread of the wheel, upon the rail, in the manner and for the purposes set forth. And the employment of plates of cast iron, upon the principie described, for the crossing of gutters, and the turning of curves."

64. For a machine for *Shaving Shingles and Staves;* William H. Wilkinson, Wayne, Warren county, Ohio, September 26.

The articles to be shaved are to be forced over irons, fixed as plane irons, on the face of a bench. Two vertical wheels, acted upon in a way described, and shown in the drawing, serve to carry the articles over the irons. There is nothing in the machine worthy of special notice. The claim is to "the arrangement of the wheels acting upon the driver."

65. For improvements in the *Wheels and Machinery of a Saw Mill;* John Muir, Menallen, Fayette county, Pennsylvania, Sept. 26.

There are to be two wheels which are to be acted upon by the water in succession, the first a small flutter wheel, the second a larger one. They are to be geared together by wheels upon their gudgeons, and an intermediate shaft; the claim is to "the addition of the large water wheel and chute, and the gearing which connects the two."

---

66. For an improvement on his *Bedstead,* patented March 31st, 1834; Perry Prettyman, Georgetown, Sussex county, Delaware, September 26.

Our notice of the patent above alluded to will be found at p. 261, Vol. 14. The difference now made is but small, and as we fully described the original plan, we shall now give the claim only from the new patent, which is to "the pins across the mortises of the posts, and the pins through the rails and catches."

---

67. For a *Mortising Machine;* Charles Gates, Antrim, Hillsborough county, New Hampshire, September 26.

The claim made in the case of the above named machine, is to "the manner of arranging the several parts on to a common bench, so that they may be removed from the upper part thereof whenever they are not wanted, and returned at pleasure." It will be seen by this claim that there is nothing special in the operating parts of the apparatus.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a Machine for spreading India Rubber upon cloth. Granted to WILLIAM ATKINSON, *Lowell, Massachusetts, August* 15, 1835.

To all whom it may concern, be it known, that I William Atkinson, of Lowell, in the county of Middlesex, and State of Massachusetts, have invented an improved machine for the purpose of spreading caoutchouc, or India rubber, in solution, upon cloth, or other material, and of drying the same by steam, and I do hereby declare that the following is a full and exact description thereof.

The cloth to be coated with India rubber is to be made into an endless web, by sewing its two ends together; and other articles, such as skins of leather, may be coated therewith by spreading them on, and affixing them to, an endless web so made. This web is passed around cylinders which are made to revolve, and the dissolved caoutchouc or India rubber, is spread upon the endless web by the aid of a third cylinder, placed parallel to, and nearly in contact with, one of the cylinders around which the endless web passes.

The dimensions of the machine may, of course, vary, according to the width and length of the material to be coated or covered. In designating certain sizes and proportions of the respective parts, therefore, I do so only for the purpose of facility in description, and of indicating what has been found to answer well in practice.

I make a frame of wood, which may be sixteen feet long, and three feet six inches wide, the bottom timbers being sufficiently stout to support the carriage, and other parts, to be presently described. Into the ground sills, or lower part of this frame, uprights are mortised, which serve to support a rail on each side, which may be three feet four inches from the floor, leaving, however, the sills sufficiently clear within the uprights to form a rail way upon which the rollers of a carriage may traverse back and forth.

Upon suitable supports, at one end of this frame, there are placed two cylinders of metal, usually of cast-iron, each of them one foot in diameter, and two feet nine inches long. The axes of these cylinders are in the same horizontal plane, and parallel to each other; around the inner cylinder the web to be coated passes; and the outer cylinder is made adjustable by means of screws, or otherwise, so that it may be brought into contact with, or removed to any required distance from, the web, or cloth. These cylinders are geared together by means of toothed wheels upon their shafts, cut sufficiently deep to admit of the requisite adjustment. The shaft of a pinion by which they are driven has on it a fast and a loose pully; when revolving they turn inwards.

The second, or carriage cylinder around which the endless web passes, is supported upon a carriage, furnished with wheels, or rollers, which run upon the lower rails, or sills. This cylinder is also to be made of metal, and when used as a drying cylinder, it should be large in diameter, say three feet. A windlass is placed at the back end of the frame, from which ropes pass to the cylinder carriage, serving, by means of a winch ,to draw the carriage, so as to render the cloth taut. Steam is to be admitted into the cylinder through a hollow gudgeon. For this purpose a steam tube is attached to the gudgeon, its other end passing through a stuffing box in a larger tube, attached to a boiler, thus admitting of the requisite motion of the carriage.

In order to apply the solution of India rubber to the cloth, &c., and to confine it to the proper width, we fit two cheeks, or pieces of wood or metal, so as to rest upon the two contiguous rollers, one at or near each of their ends, and these, when in their places, convert the rollers into a trough, or hopper, for containing the solution. The distance of these pieces from each other is regulated by attaching them together by means of a frame, or rod, at their upper sides, so that they may slide, and be affixed in their places by thumb screws, or otherwise.

When spreading the rubber on the cloth it is necessary to prevent its adhering to the outer roller, and this, among other methods, may be effected, by means of wet sponges, or brushes, laid along it, or by keeping it wet in any other way.

I intend sometimes to use the drying and the spreading apparatus detached from each other, in which case but two rollers, of any convenient size, will be employed in the drying process, and steam may then be introduced into each of them. I intend also, sometimes, instead of the large drying cylinder above described, to cause the cloth to pass over a stationary metallic box, or steam case, in its passage from the spreading to the straining or carriage roller, making the upper surface of this case convex, that the cloth may be kept in close contact with it; the space between the two sides of such box, or case, need not be more than from one to two inches.

What I claim as my invention, and for which I ask letters patent, in the above described apparatus, is a machine for spreading India rubber upon cloth constructed, and operating, substantially, in the manner of that herein set forth. I do not claim the mere spreading of the substance by means of cylinders, this having been previously done, but we do claim the employment of two cylinders for the purpose, connected together, and made to concur, in producing this effect, acting upon the principles described. I also claim the general arrangement and application of the apparatus, for the drying of the solution by means of steam, either in combination with, or separate from, the spreading apparatus, as I contemplate the using of them either conjointly or separately, as hereinbefore set forth. I do not claim drying cylinders, or boxes, heated by steam. as my invention or discovery, but the combination and application thereof in the way, and for the purpose by me herein fully made known.

Specification of a Patent for an improvement in the manner of preparing and leaching Ashes, and manufacturing Potash. Granted to Elijah Williams, *Harbour Creek, Erie county, Pennsylvania, August* 15*th*, 1835.

To all to whom these presents shall come—greeting,—Be it known, that I, Elijah Williams, of Harbour Creek, Erie county, State of Pennsylvania, have discovered and invented an improvement in preparing and leaching ashes and making Potash, and that the following is a full and exact description of the same, namely. The said improvement consists of two parts.

First. Burning over crude ashes in a large body, by building fires under, in, or on them, which will in a few days burn the coal and most other impurities out of them. They are then in a running hot state, and in this manner they are boiled in pure water, or weak lye, about fifteen minutes with a brisk fire, using about equal proportions of water and ashes; then add unslacked lime, in the proportion of about one bushel of lime to ten or twelve bushels of ashes. Boil a few minutes longer, and let it off in the leach during the effervescence.

Second. The boiled ashes are to be put in leaches from six to eight inches in depth, and boiling water applied until the strength is out of them; the ley is then boiled and melted down in the usual manner, this method produces a beautiful white article yielding from ten to fifteen per cent. more pure alkali than the best samples of commercial potash, manufactured upon any plan heretofore known, as I believe.

Lime has heretofore been used in many ways in the manufacture of potash, but the inventor claims that the plan of burning over, and boiling the hot ashes, and the unslacked lime and letting them into the leach during the effervescence, as before described, was discovered by him, and is the chemical process on which he depends: he also claims that he did invent the hereinafter described machinery for the purpose of manufacturing ashes. The boiler used for boiling ashes, or ley, should be made of sheet-iron, or copper, on the following construction. With a flat bottom, about three feet six inches in width, about seven feet in length from twelve to sixteen inches deep, with a tube in the side, or end, for the purpose of letting off the contents—the size of said boiler may be increased and diminished, and it is to be set in an arch for use; the leaching trough should be about twenty feet long, two and a half feet wide, and twelve or fourteen inches deep, with a flat bottom, having a lime strainer fixed about two inches above the bottom, and a tube below the strainer, for the purpose of letting off the ley.

Directions.—The boiler being set in an arch for use, put in of burned over hot ashes, about ten bushels, with as many bushels of water, or weak ley, boil with a brisk fire about fifteen minutes, then put in one bushel of unslacked lime, boil about as much longer if it does not go over, then let it off into the leaching trough during the effervescence. A greater or less charge may be put in according to the size of the boiler and leaching trough. Have the boiled ashes from six to eight inches in depth in the leaches; then first put on weak ley, hot if you have it, after which continue with hot water until the strength is off, boil the ley, and melt down in the usual manner.

Clear ashes may be worked, (if not hot) by using more lime and boiling longer, but not to so good effect.

ELIJAH WILLIAMS.

Remarks by the Editor.—The practice of reburning the ashes was adopted, and proceeded in for a considerable length of time, more than forty years ago; and it was at first imagined that the amount of potash was thereby considerably increased. It was at length discovered, however, that the bulk was considerably reduced by the reburning, and that the apparent increase was principally due to this circumstance; the small increase produced by reducing the coal to ashes did not nearly compensate for the expense and labour of burning, and the plan was abandoned. We apprehend that the increased production spoken of by the patentee will be found to arise from the cause above stated.

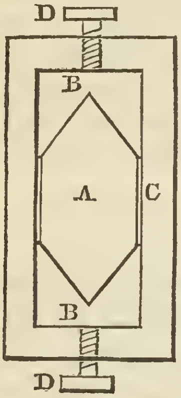
Specification of a Patent for a Mode of Fitting the Boxes for Gudgeons into the Plummer Blocks; and also the fitting of the Bearing of the Slides for Locomotive and other Steam Engines, and for other purposes. Granted to MATTHIAS W. BALDWIN, *city of Philadelphia, August 17th,* 1835.

To all whom it may concern, be it known, that I, Matthias W. Baldwin, machinist, of the city of Philadelphia, in the state of Pennsylvania, have invented a new and improved mode of fitting the boxes within which gudgeons are to run, into plummer blocks, and also of fitting and adjusting the bearings of slides, or guides, for piston rods; which inventions are applicable to locomotive engines, and also to other purposes. And I do hereby declare that the following is a full and exact description thereof.

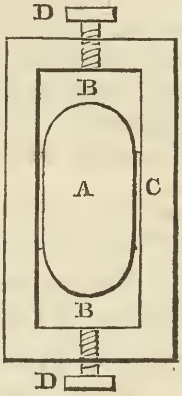
The boxes in which the gudgeons used about locomotive and other steam engines, and machinery of various kinds, are received, and turn, have heretofore been fitted into the plummer blocks, or pedestals, made to receive them, by filing, or other analogous means, their ends being made either square, or angular, and adapted to corresponding parts in the plummer block, or pedestal, prepared to receive them. My improved mode of fitting them consists in turning or boring the opening, or seat in the plummer block, into which the boxes are to be fitted, so as to make each of the cheeks cylindrical segments. The boxes in which the gudgeon is to run, are then to be attached to each other by screws, or otherwise, and turned by means of a slide rest, or worked in any other manner, so as to make their ends cylindrical, and to cause them to fit exactly to the cylindrical cheeks, prepared for their reception, in the plummer block.

In constructing the slides for the pistons of locomotive and other steam engines, and for other purposes, the slide bar has usually been made square, or four sided, and its angles usually right angles; and the brasses, or bearings, contained in the box within which it slides, have been adjusted to it by set screws operating upon three sides thereof. In my improved mode of construction, the adjustment is made to operate upon two sides, or edges, only. For this purpose, I make my slide bar flat on two sides, and the other two sides, or edges, half round, or otherwise form them into two planes, meeting each other along the middle thereof, by which means the rod will become six sided, this latter form being preferred to the rounding of the edges. The box within which the bar slides, is provided with two brasses, or bearing pieces, with hollows, or grooves, in them, adapted to the edges of the sliding bar, and fitting accurately between the parallel sides of the box; when, therefore, the brasses, or bearings, are adjusted to the edges of the rod by set screws acting against them, the rod is embraced by them so as effectually to check all tendency to a lateral motion, as will appear by an inspection of the drawings deposited in the Patent Office.

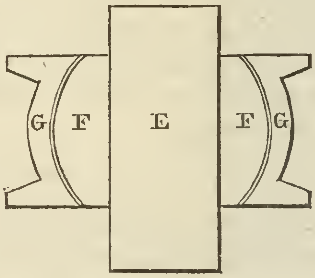
Fig. 1



2



3



Figs. 1 and 2, cross sections of the box and slide bar, with angular and with circular fittings.

A, slide bar.

B, brasses, or bearings.

C, boxes.

D, adjusting screws.

Fig. 3, horizontal section of a plummer block and boxes, through the centre of the gudgeon.

E, gudgeon.

F, box.

G, cheeks of the plummer block.

What I claim as my invention, and wish to secure by letters patent, is the mode of fitting the boxes of gudgeons into plummer blocks, pedestals, or other receptacles, by boring, turning, or otherwise, so as to make the fittings cylindrical. I also claim the fitting of the slides for the pistons of locomotive engines, and for other purposes, into brasses, or boxes, adjusted and operating in the manner hereinbefore set forth.

MATTHIAS W. BALDWIN.

Specification of a Patent for a mode of destroying Weevils, in Grain; to expel moisture from grain, meal, and manufactured flour, and for drying malt. Granted to JAMES A. LEE, *Administrator of James Lee, deceased, Maysville, Mason county, Kentucky, August* 17th, 1835.

To all to whom these presents shall come: Be it known, that James Lee, deceased, of the town of Vevay, in the county of Switzerland, and State of Indiana, in his life-time, invented a new and useful improvement for destroying weevils and other insects and their eggs, in grain, meal, and manufactured flour, and for drying malt, and that the following is a full and clear description of the same, as invented or improved by him.

This improvement consists of one, or more, hollow cylinders, or prisms, made of sheet-iron, or other metal, of any required dimensions in diameter or length. Fixed on an angle in an inclining position, in the manner of a bolting-reel as is used in mills for bolting flour; it is enclosed in an oven or arched room, made of brick, stone, or other material, sufficiently wide to contain one or more cylinders, or prisms, aside of each other, and of height sufficient to admit of one or more stoves, or flues, calculated to communicate to the cylinders, or prisms, the quantity of heat required for destroying the living insects and their eggs in the grain, and for thoroughly expelling the moisture from the grain, malt, meal, or manufactured flour; the cylinders, or prisms can be moved either by hand, or machinery; the grain, malt, meal, or flour, is introduced through a hopper at the upper end of the cylinder, or prism, and by its inclining position and revolutions it is carried to the lower end, where it is discharged; in its passage down, the grain and malt is kept rolling, the meal and flour is constantly kept in a floating, pulverized state, not subject to concretion, or coagulation, and to prevent the meal, &c. from adhering to the cylinder, or prism, and being subject to be burnt, I fix several combs on the surface of the cylinder, to raise strikers of sufficient weight or force, to jar the cylinder, so as to disengage the meal, or flour, that may adhere to it.

By the process in this improvement the living weevils, or other insects, will be killed, and their eggs destroyed; the moisture in the grain, malt, or manufactured flour, and meal, will be effectually expelled, so that when repacked into seasoned barrels, and stored in dry places, the grain, meal, or flour, may be kept sweet for years in the warmest climates, free from fermentation or putrefaction and the ravages of insects, and the malt dried as may be required, at the same time the germinated parts of the malted grain will be broken off by the revolutions of the cylinder, or prisms. It is not necessary that the meal or flour, should be cooled before repacking; the moisture being driven out, it cannot spoil, and may be suffered to cool in the barrels.

Now what I claim as new and as the invention of the said James Lee, deceased, for which I solicit letters patent, is, the use of the hollow, inclined cylinder, cylinders, or prisms; and strikers, in connection with a chamber, or oven, heated by means of stoves, or flues, operating in the manner and for the purposes herein set forth and described.

In testimony that the foregoing is a true specification of my late father's invention, or improvement, I have hereunto set my hand at the city of Washington, in the District of Columbia, this 3d day of August, 1835.

JAMES A. LEE, Administrator.

Specification of a patent for improvements in the process of, and apparatus for, Distilling Spirits of Turpentine and other articles. Granted to ISAIAH JENNINGS, *city of New York, August 27th* 1835.

To all whom it may concern: Be it known, that I, Isaiah Jennings, of the city of New York, in the State of New York, have invented certain improvements in the process, and also in the apparatus employed, for the distillation of Spirits of Turpentine, the spirit from common tar, coal tar, and other analogous articles; and I do hereby declare that the following is a full and exact description thereof.

My improvement in the process when turpentine is to be distilled, consists in the addition of a portion of spirits of turpentine to the crude turpentine from which the distillation is to be made; the addition being made in such proportion as shall bring the turpentine into such a state of fluidity as shall admit of the subsidence of all the foreign matter contained therein as may be sufficiently heavy to fall to the bottom, and of the rising of chips, and other light materials to the surface, whence they may be readily removed, and the clear turpentine poured off from the sediment. The quantity of spirits of turpentine to be added will depend, in part, upon the warmth of the weather, or of the place in which the mixture is made; and also upon the thickness of the turpentine to be operated upon, and the impurities which it may contain. The mixture and separation of the impurities may be promoted by artificial heat, care being taken that the temperature is not such as shall occasion a waste of the spirit by evaporation.

The apparatus which I employ consists of two vessels within each of which a still worm of the usual construction is to be contained; or instead of the worm any kind of heater, or refrigerator, by which analogous effects are produced, may be employed; these vessels are to be connected together in a way to be presently described, and one of them is to answer the purpose of a still, whilst the other is to operate as a refrigerator, or condenser. The prepared turpentine is to be contained in any convenient reservoir whence it may descend through a tube into the worm which is to operate as a distillatory, its flow being regulated by a stop cock. The vessel containing this worm is to be closed at top, and the worm is to be heated by the introduction of steam, heated air, water, or other fluid; steam, however, being preferred; a sufficient degree of heat may be thus applied to separate the spirit from the rosin as the material descends from the top to the bottom of the worm. The lower end of this worm passes through the vessel, and into a large vertical tube which is placed between it and the refrigerator or condenser. This vertical tube rises as high as the top of the condenser, and descends several inches below the point at which the first named worm enters it, having below this point a tube for the discharge of the rosin, which, not being volatile, will descend and run out by its own gravity. Its flow may be regulated by a stop cock, and may be promoted, if necessary, by the application of heat to the bottom of the tube.

The vapour of the spirit will rise towards the upper end of the tube,whence it will pass into the refrigerating worm contained in the condensing tube, down which it will pass, and be condensed in the usual way.

I intend to apply the same apparatus to the distillation of common tar, coal tar, and other analogous articles, diluting them also, with a portion of their own spirit, or with any other which will produce a like effect.

What I claim as my invention, is the preparing the turpentine for distillation by diluting it with distilled spirit, and separating, by this means, the foreign matter therefrom, thereby producing a bright clear rosin, and an improved spirit. I also claim the employment of the worm, or other analogous apparatus, to be heated in the way described, and arranged and connected in the manner, or upon the principle herein set forth, so that it may answer the purposes for which it is ordinarily employed. I also claim the preparing and distilling of common tar, coal tar, and other analogous articles by dilution, and subsequent distillation in the same apparatus.

Isaiah Jennings.

Specification of an improvement in the art of Public Finance, in loaning and actually employing credit. Granted to John Golder, *city of Philadelphia, September* 26, 1835.

To all to whom these presents shall come, be it known that I, John Golder, of the city of Philadelphia, in the State of Pennsylvania, have invented, discovered, and formed, a new and valuable accumulative or interest bearing check or credit chart, based upon a new principle in monetary negociations, as a useful improvement in the art of finance, to be used only in the negociation of loans upon contract with actual capitalists, or in the guarantee or transfer of bona fide deposites and investments to be made; a full and exact description of which impress, and drawing thereof, as invented by me. and hereafter is to be used as aforesaid, only excepting the names, sums, vignettes, which are at all times to be written and filled up in the own proper hand writing of the person or persons concerned, conformably to the contracts made, or to be made, with the party, or parties contracting therefor. is hereunto annexed. And the inventor and author claims as his invention. not only the design and writing of the chart, or check above described, and attached hereto; according to its specific form and definite advantages of creating and sustaining credit upon its peculiar solid principle of accumulative action, and the right and privilege of using it as an improvement in the negociation of loans, and investment of capital, upon permanent visible security, but also the operative principle upon which it is based, which will admit of numerous variations in its form or manner of wording, or constructing the same, whilst the principle upon which it is intended to operate will remain substantially the same, and would therefore be necessarily considered as an evasion of my right.

John Golder.

MUTUAL CREDIT OFFICE CHECK, OR CHART,

Each check or chart is endorsed by the Actuary, negociable on demand, in payment of instalments, or in purchase of stock.

Golder's Accumulative Patented Interest bearing Check or Chart.

PAYABLE ON DEMAND, WITH INTEREST FROM DATE.

No. *Philadelphia*

Actuary of Golder's Mutual Credit of Loan and Deposit Office, pay to the order of or bearer, dollars and cents, with interest computed at per cent., from the entry hereof, the same being negociated for, and payment guaranteed by actual deposit at the Company's office this day.

Entered day of 183

Secretary, JOHN GOLDER, [L. S.]

Industry is Gain.

Remarks by the Editor.—When wheels, levers, or pistons are in question, we feel as though we could talk familiarly and intelligibly about them; but when "Divitial inventions" and "Accumulative Checks" are upon the tapis, we are among foreigners and strangers whose language we do not understand. We have never had occasion to become learned in monetary matters, being entirely destitute of the organ of pecuniary acquisitiveness. Under these circumstances we must not be looked to for any explanation of the plan before us, but as some of our readers are versed in the business of stocks and loans, it is, therefore, presented to them for their consideration.

Whether the foregoing is sustainable under a patent, does not depend upon its novelty merely, but more essentially upon the determination of the question whether the *Art of Finance*, can be classed among what are technically called "the useful arts."

Specification of a Patent for an improvement in the Mode of Turning Short Curves upon Rail-roads, with Rail-road Carriages, particularly those round the corners of streets, wharves, &c. Granted to James Stimpson, *Civil Engineer, Baltimore, Maryland, August 23d,* 1831. *Patent surrendered, and reissued on an amended specification, September 26th,* 1835.

I use, or apply, the common peripheries of the flanches of the wheels, for the aforesaid purpose, in the following manner.

I lay a flat rail, which, however, may be grooved, if preferred, at the commencement of the curvature, and in a position to be centrally under the flanches of the wheels upon the outer track of the circle, so that no other part of the wheels which run upon the outer circle of the track rails, shall touch, or bear upon, the rails, but the peripheries of the flanches, they bearing the whole weight of the load and carriage; while the opposite wheels, which run upon the inner track of the circle, are to run and bear upon their treads, in the usual way, and their flanches run freely in a groove, or channel; which treads are, ordinarily, about three inches in diameter, less than the peripheries of the flanches. Were the bearing surfaces of the wheels, which are in contact with the rails, while thus turning the curve, to be connected by straight lines from every point, there would thus be formed the frustrums of two cones, if there be four wheels and two axles to the carriage; or, if but one axle, and two wheels, then but one cone; which frustrums for the wheels representing their extremities, will, if the wheels are thirty inches in diameter, and are coupled about three feet six inches apart, turn a curve of about sixty feet radius of the inner track rail. The difference in diameter between the flanches and treads, before stated, the tracks of the usual width, and the wheels coupled, as stated, would turn a curve of a somewhat smaller radius if the axles were not confined to the carriage in a parallel position with each other; but this being generally deemed necessary, the wheels run upon lines of tangents, and those upon the inner track being as wide apart in the coupling as the outer ones, keep constantly inclining the carriage outwards, and thus cause the carriage to tend to run upon a larger circle than the difference in diameters of the treads and flanches would otherwise give; but the depth of the flanches, and the couplings, may be so varied as to turn any other radius of a circle desired.

What I claim as my invention, or improvement, is the application of the flanches of the wheels on one side of rail-road carriages, and of the treads of the wheels on the other sides, to turn curves upon railways, particularly such as turning the corners of streets, wharves, &c., in cities and elsewhere, operating upon the principles herein set forth.

James Stimpson.

Foster and Avery's Rotary Steam Engine.

We made some remarks on the subject of this engine in the last number and as it has attracted considerable attention, we have determined to publish the specification entire, in order that the nature and amount of the part claimed may be fully understood. This, with some further remarks upon it, was crowded out of the last number of the Journal, and, upon reflection, we have determined to omit the said remarks, and to give the specification alone. The original notice of this engine may be found at p. 171, vol. ix.—[Editor.

Specification of a Patent for an improvement in the Reacting Steam Engine. Granted to Ambrose Foster, *Brutus, Cayuga county,* and William Avery, *Salina, Onondaga county, New York, September 28th,* 1831.

To all whom it may concern, be it known, that we, Ambrose Foster, of Brutus, Cayuga county, and William Avery, of Salina, Onondaga county, in the state of New York, have invented a certain improvement in the steam engine, commonly called the reacting engine, and that the following is a full and exact description of our said improvement.

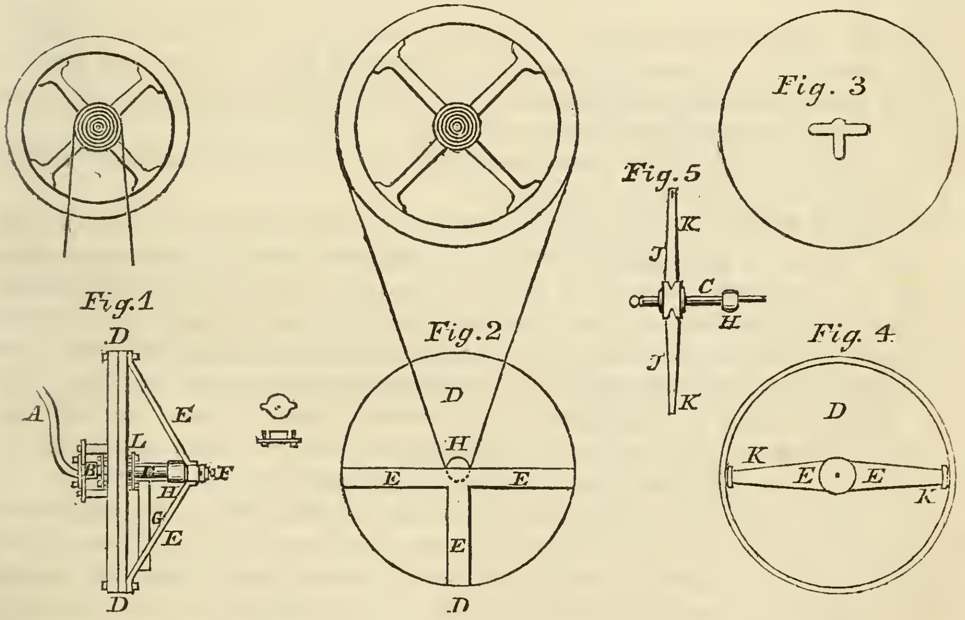


Fig. 1, in the accompanying drawing, represents a side view of the engine, the revolving arms not being visible, in consequence of their being enclosed in a circular case, to be presently described. A is a steam tube, connected with a boiler, and forming a steam-tight joint, in the box B, where it opens into the shaft C, which is made hollow to the requisite depth. D is the edge, or periphery, of a case, or drum, within which the arms from which the steam is to issue, revolve. E, E, are braces, which may be attached to the case, or drum, and at their junction support a socket, containing a centre pin, or screw, F, against which the shaft C is to run. G is a tube, through which the steam passing into the case from the revolving arms, is allowed to escape; a portion of this steam is employed to heat the water by which the boiler is to be supplied. H is a whirl upon the shaft

C, a strap from which may be employed to drive machinery. Where the same parts occur in the other figures in the drawing, they are represented by the same letters.

Fig. 2, shows the flat side of the drum, or case; the arms, or braces, E, E; the whirl, H, and the manner in which straps, or other gearing, may be carried from one wheel to another. Fig. 3, is the opposite side of the drum, or case.

E, E, in Fig. 4, shows the flat sides of the revolving hollow arms; and J, J, Fig. 5, is an edge view of the same. In Fig. 4, one side of the case is supposed to be removed, and, in Fig. 5, the whole case. At K, K, openings are made in the narrow edges of the arms, in directions opposite to each other, to allow of the escape of the steam introduced into them through the shaft C, with the hollow of which they communicate.

In an engine which we have in actual operation, the arms, E, E, (or J, J,) are each twenty inches in length. The width of the arms at the centre is about six inches, and at the ends about two and a half inches; in depth, or thickness, they are about one and a half inches near the centre, and about three-fourths of an inch near the end. The size of the holes through which the steam escapes, is about one-quarter, by one-eighth, of an inch. The holes are so perforated that the steam shall issue at right angles with the shaft.

We have found this engine to act with great power, but do not intend to confine ourselves to these particular proportions, as we mean not only to vary the size of our engines, but also the relative proportions of their respective parts, according to circumstances.

L, L, are parts of stuffing boxes, employed to prevent the escape of steam, in a manner well known to machinists.

We find it to be a point of great importance to give such a form to the revolving arms, as shall subject them to the least possible resistance from the air; we, therefore, instead of making them in the form of round tubes, which has been heretofore done, give to them the form which results from making each half of the arm a segment of a large circle, so that, when the two halves are united, the edges of the tube present acute angles. The tubes, however, may be made elliptical, or oval, and the same end will be, in a great measure, attained. We use any number of such arms on the same shaft, as we may find best adapted to our purpose.

We do not claim to be the inventors of the reacting steam engine, nor of the case, or drum, within which we intend the arms shall, in general, revolve; but what we claim as our invention, is, simply, the giving the oblate, or flat, form to the revolving arms, so that, in proportion to their capacity, they shall experience much less resistance from the air than that to which they have been heretofore subjected, thereby obtaining a greatly increased power.

AMBROSE FOSTER,
WILLIAM AVERY.

Progress of Theoretical and Practical Mechanics.

Lever and Spring Balances. By CHARLES T. COATHUPE.

The public are already indebted to the ingenuity of many for various contrivances adapted to the purpose of weighing. Some have vastly improved the convenience of the old-fashioned beam. Others have devoted their attention to supersede the employment of weights, by the use of oval or spiral springs, and have produced very effective and perfect instruments, with all the accuracy necessary for their intention, such as Marriott's Dial, and Salter's Spring Balance. But no person has yet availed himself of the effects which are to be derived from the union of the two principles already adopted. It is, then, with all due deference to the better judgment of others, that I propose a machine of very easy manufacture, and small expense, by combining the lever with the spring balances of Marriott, or Salter, which appears to offer many advantages over either used alone.

Fig. 1 represents the arrangement for heavy weights, where we will suppose the distance from the fulcrum to the point of suspension to which the spring balance is attached, to be eight times the distance of the fulcrum from the point to which the weight is to be suspended. Salter's balances, graduated to weigh 24 lbs., and whose cost is about five shillings, will then weigh 192 lbs., and each $\frac{1}{4}$ lb. division will indicate 2 lbs.

Fig. 1.

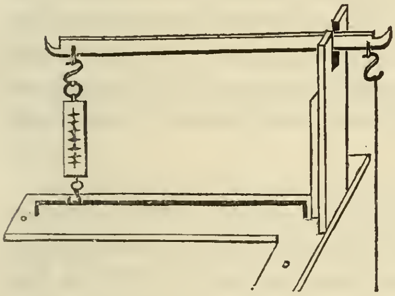


Fig. 2.

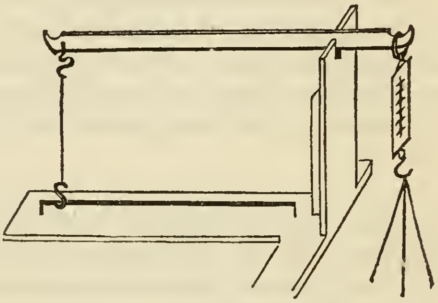
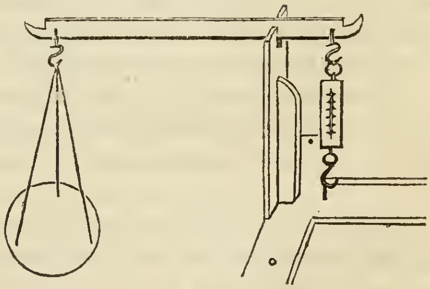


Fig. 2 is the reverse application, and may be used for light weights. Of course, each $\frac{1}{4}$ lb. division will then represent only $\frac{1}{4}$ oz.

Fig. 3 is merely the conversion of the lever to a simple hook for supporting the spring balance, when used in the ordinary manner for immediate purposes.

It is obvious that, with a combination of this kind, and using one of Marriott's dials, calculated to weigh 2 cwt., we may readily make it available for weighing a ton, and thus have not only the perfect use of the dial itself, when detached, but a machine capable of weighing very heavy packages without weights, thereby avoiding the expense of such weights, the trouble of removing them, and the risk of a false computation.—[*Lond. Mech. Mag.*

Fig. 3.



Effect of the velocity of Air upon its use in Smelting Iron.—M. Teploff, one of the Russian Mining Corps, in an article on the improvements recently introduced into the smelting of iron in Russia, makes the following statement. In the smelting furnaces of the Ural, where the quantity and velocity of the blast are properly regulated, 1.4 of pig iron is obtained by 1 of charcoal fuel, while in other furnaces they obtain but .4 and .6 by the same consumption of fuel.

The velocity of the blast being increased, the heat within is increased, without a corresponding consumption of fuel. In an experiment made by order of the government, it was found that one hundred cubic feet of air, under a pressure of two inches of mercury, produced the same effect as two hundred cubic feet, under a pressure of one inch, with this difference, that, in the latter case, twice the fuel was consumed, which was required in the former case.

In one furnace which is mentioned, 22,000 lbs. of iron were obtained in twenty-four hours, by 16,000 lbs. of charcoal. Previous to the due regulation of the draught, they consumed twice this amount of fuel for the same yield of iron.

This economy is obtained by duly proportioning to each other the size of the blast pipe, and the pressure of the draught. The relation of these to each other, varies with the furnace.

M. Teploff asserts that the results thus obtained exceed those with the hot air blast, but it does not appear that any comparisons have been made under his examination, and with the charcoal fuel.

To regulate the draught, it is recommended to place two mercury or water gauges, one near the blast pipe, the other near the governor of the blowing machine. By varying the pressure, and the diameter of the nozzle of the blast pipe, making the latter smaller as the former is increased, and vice versa, the best proportion is to be ascertained.—[*Annales des Mines, vol.* vii.

Preservation of Wood from Dry Rot.—It is stated as the result of observations made in the German mines, that pine wood, which has been exposed to the action of water under pressure, is not subject to the dry rot. A stick of pine wood, placed in water in an iron pipe, absorbed, in thirty-six days, 27 per cent. of water. Subsequent exposure for thirteen days, in a warm room, evaporated 15½ parts of the water.

A similar stick of wood, exposed for the same time, but pressed, at intervals, by a force of nearly fifty atmospheres, absorbed 118 per cent. of water. Of this, when the wood was exposed as above stated for the other piece of timber, there evaporated 21 parts.

The wood was not sensibly increased in bulk by the absorption of the water. The bulk of water absorbed in the second experiment having been nearly one-thirty-ninth that of the wood.—[*Ibid.*

Proportion of Ashes in different parts of Wood.—A portion of heart wood, of sap wood, and of intermediate layers, of the trunk of an oak of sixty years of age, which had grown in a sandy loam, were separately burned. The heart yielded .27 per cent. of ashes, the middle layers .34 per cent., and the sap wood .532 per cent.—[*Journ. of Pract. Chem.* (*Germ.*) *Ann. des Mines, vol.* vii.

Progress of Physical Science.

Experimental researches in Electricity. Eighth Series. By MICHAEL FARADAY, *&c. &c. Phil. Trans. Lond.* 1835.*

1. Metallic contact is not necessary to the production of the voltaic current. Decomposition of iodide of potassium is obtained by zinc and platinum

---

* Abstract made for this Journal.—[COM. PUB.]

plates, immersed in part in a diluted acid, and separated above the acid solution by a piece of paper moistened with the iodide. The iodine appears at the platinum wire terminating the platinum plate.

2. Metallic contact is effective by opening a path for the voltaic current without introducing any new affinities to oppose that of the exciting fluid. Such an opposition would occur, if compounds capable of being decomposed by the current, were used to connect one set of extremities of the plates, while the other extremities were dipped into a dilute acid.

3. A simple galvanic circle is capable of effecting chemical decompositions when the elements of compounds are united by a weak affinity, or by proportioning the affinities producing to the current to those of the compounds to be acted upon.

The following compounds are placed in the order of facility of decomposition, the first requiring the lowest intensity of current.

Iodide of potassium (solution). Chloride of silver (fused). Protochloride of tin (fused). Chloride of lead (fused). Iodide of lead (fused). Muriatic acid (solution). Water acidulated with sulphuric acid.

4. "The electricity of the voltaic pile is not dependent either in its origin or its continuance on the contact of the metals with each other. It is essentially due to chemical action, and is proportionate in its intensity to the intensity of the affinities concerned in its production; and in its quantity to the quantity of matter which has been chemically active during its evolution."

5. "Volta-electric decomposition is simply a case of the preponderance of one set of chemical affinities more powerful in their nature over another set which are less powerful; and if the instance of two opposing sets of such forces be considered, and their mutual relation and dependence borne in mind, there appears no necessity for using, in respect to such cases, any other term than chemical affinity (though that of electricity may be very convenient,) or supposing any new agent to be concerned in producing the results; for we may consider that the powers at the two places of action are in direct communication, and balanced against each other through the medium of the metals, in a manner analogous to that in which mechanical forces are balanced against each other by the intervention of the lever."

6. "All the facts show us that the power commonly called chemical affinity can be communicated to a distance through the metals and certain forms of carbon ; that the electric current is only another form of the forces of chemical affinity; that its power is in proportion to the chemical affinities producing it; that when it is deficient in force it may be helped by calling in chemical aid, the want in the former being made up by an equivalent of the latter; that in other words, the force termed chemical affinity and electricity are one and the same."

7. Chemical action is not of itself sufficient to produce an electrical current, the substance acting chemically must be in combination, and in such a state of combination as to be capable of decomposition by electricity. Thus liquid chlorine will dissolve the zinc of a voltaic battery, but no electrical current will result. It is not sufficient that a body act chemically, and be a conductor of electricity, it must be decomposable. Thus, metallic tin acting on platinum plates evolves no electricity.

It follows from this, that the sulphuric acid used in the battery evolves no electricity in combining with the oxide of zinc. It merely dissolves the oxide, exposing a fresh surface to oxidation.

8. Notwithstanding the extraordinary state which must be assumed by an

electrolyte either during decomposition, when an enormous quantity of electricity must be traversing it, or in the state of tension which is assumed as preceding decomposition, still it has no power of affecting a ray of polarized light, and hence no peculiar structure is to be inferred in this way.

9. The state of tension just referred to may be rendered evident by immersing in dilute sulphuric acid a single pair of galvanic cylinders, provided with cups to contain mercury, making an electrical communication for the plates by means of an amalgamated wire. On dipping one end of the wire into one of the mercury cups, and bringing the other end *near* the other cup, a spark passes through the intervening air.

10. Mr. Faraday next examines fully by experiment the following questions. Can electrolytes (bodies capable of decomposition by electrical currents) resist an electrical current below a certain intensity? Is the intensity at which the current ceases to act the same for all bodies? Will electrolytes thus resisting decomposition conduct electricity or serve as insulators?

(*a.*) A current excited by the action of dilute sulphuric acid on a pair of zinc or platinum plates was capable of decomposing iodide of potassium, but not water. The current evolved with the same plates, when nitric acid was added, decomposed water. A current which decomposes a solution of iodide of potassium may not be able to decompose one of sulphate of soda, the current being conducted in each of these cases.

(*b.*) In similar experiments fused chloride of silver was decomposed by a current which was conducted, without decomposition, by fused chloride of lead, and by fused nitre.

(*c.*) Water, whether pure or acidulated, seems to be equally decomposable by an electrical current, and has the same conducting power, whether pure or acidulated, for currents unable to decompose it.

11. A curious conclusion from the view of a certain electrical intensity being necessary to the decomposition of bodies is, that "we may arrange circumstances so that the *same quantity* of electricity may pass in the *same time*, in at the *same surface*, into the *same decomposing body*, *in the same state*, and yet differ in intensity, *decomposing in one case and not in the other*. For taking a source of too low an intensity to decompose, and ascertaining the quantity passed in a given time, it is easy to take another source having a sufficient intensity, and reducing the quantity of electricity from it by the intervention of bad conductors to the same proportion as the former current, and then all the conditions will be fulfilled to produce the result described.

12. In considering the effects of many alternations of simple galvanic circles, giving rise to the battery, Mr. Faraday gives the following view of the increase of intensity with the number of pairs of plates, while the quantity remains the same. "The electricity which passes across the acid from the zinc to the platinum in the first cell, and which has been associated with, or even originated by, the decomposition of a definite portion of water in that cell, cannot pass from the zinc to the platinum in the second cell without the decomposition of the same quantity of water there, and the oxidation of the same quantity of zinc by it." The quantity of electrolyte decomposed, and of electricity passed, must, as has been before shown, be the equivalents of each other. "The action in each cell, therefore, is not to increase the quantity set in motion in any one cell, but to aid in urging forward that quantity, the passing of which is consistent with the oxidation of its own zinc; and in this way it excites that peculiar property of the current which we endeavour to express by the term *intensity*, without increas-

ing the *quantity* beyond that which is proportionate to the quantity of zinc oxidized in any single cell of the series."

(*a.*) In proof of this position, ten pairs of amalgamated zinc and platinum plates were arranged with dilute sulphuric acid, forming a battery. When the circuit was completed, hydrogen was given off in each cell, and being collected, proved the same for each cell of the battery and chemically equivalent to the zinc dissolved.

(*b.*) This fact has been proved "long ago, in another way, by the action of the evolved current on a magnetic needle; the deflecting power of one pair of plates in a battery, being equal to the deflecting power of the whole, provided the wires used be sufficiently large to carry the current of the single pair freely; but the *cause* of this equality of action could not be understood whilst the definite action and evolution of electricity remained unknown."

(*c.*) "Whatever *intensity* may be," "there seems to be no difficulty in comprehending that the *degree* of intensity at which a current is evolved by a first voltaic element, shall be increased when that current is subjected to the action of a second voltaic element, acting in conformity and possessing equal powers with the first." Since the act of decomposition opposes a certain force to the electric current, and one which is of the same kind with this force, it is obvious that bodies may resist a current of one intensity, and give way to a more powerful one. Nor does this contradict the law of definite electrical action.

(TO BE CONTINUED.)

Tellurium, and its Compounds with Oxygen.—Pure tellurium may, according to Berzelius, be procured by mixing the ore with carbonate of potassa, or of soda and oil. The mixture is exposed to heat in a crucible. When the oil has been decomposed, the heat should be raised for a short time nearly to whiteness. Water passed through the substance remaining in the crucible dissolves the telluret of potassium. This liquid must be kept during the washing from air, if all the tellurium is to be extracted. The telluret of potassium exposed to the air deposits tellurium, the potassium oxidating. By distillation the metal is purified. To effect its conversion into vapour, the highest heat of a small wind furnace, aided by a stream of hydrogen gas, is necessary.

With proper precautions sulphurous acid may be used to precipitate tellurium from its solution in muriatic acid. The metal appears in flakes, and not as a black powder, as when obtained by the process above described.

Tellurium is brittle and crystalline. Its specific gravity is about 6.2. It vapourizes at a temperature at which white glass is too soft to confine the vapour. The odour of volatilized tellurium is different from either sulphur or selenium, to which bodies it is allied in its general character. The equivalent is nearly 8.02.

The substance commonly considered as oxide of tellurium, formed by the action of nitric acid on tellurium, Berzelius finds to be an acid for which he proposes the name tellurous acid. Of this acid he describes two varieties. One of them contains water, the other is anhydrous. They contain two equivalents of oxygen united with one of the metal.

Telluric acid is obtained by oxidating tellurous acid by nitre, or by acting upon tellurite of potassa by chlorine. Decomposing the tellurate thus formed by chloride of barium, and in turn decomposing the insoluble tellurate of baryta by sulphuric acid. This acid contains three equivalents of oxygen. The crystalized acid contains three equivalents of water.

The two acids just referred to are similar in composition to sulphurous and sulphuric acids. Berzelius was not successful in his attempts to procure hypo-telluric acid, nor in those to obtain a lower degree of oxidation than tellurous acid.—*Ann. de Chim. et de Phys.*

Oxygen in Air contained in Snow.—M. Boussingault found in snow water, collected in his descent from Chimborazo, but 16 per cent. of oxygen.—*Ibid.*

Flint and Chalcedony not Simple Minerals.—Professor Fuchs, of Munich, finds that opal, which is amorphous silica, dissolves in caustic potash even when in mass, and that in powder it is rapidly taken up. Powdered opal unites with lime in the moist way, and the mass hardens under water.—*Ibid.*

Flint is a mixture of quartz and opal, and the latter may be separated from fragments of flint by potash. Chalcedony contains more of it than flint.—*Jameson's Journal.*

Temperature of the Earth, as shown by that of the Waters of Artesian Wells.—M. Arago states as the result of observations not published, that the temperature of the water from these wells increases with the depth of the source, at the rate of one degree Fah. for every thirty-seven to fifty-four feet.—*Jameson's Journal.*

Quantity of Rain at Different Elevations.—The register of the rain fallen at Kinfauns Castle, for the year ending in December, 1834, gives 23.10 inches by a rain gauge in the garden, 20 feet above the level of the sea, 23.25 by a gauge in the Castle tower, 180 feet above the same level. The *greater* quantity at the *upper* level.

Mechanics' Register.

Berlin Iron Ornaments.—Some of these are so fine, consisting of rosettes, medallions, &c., that nearly ten thousand go to the pound. In the coarse fabrics the value of the material is increased by manufacturing eleven hundred times, and in the finer nearly ten thousand times.—*Arcana of Science*, 1835.

Mortality in Europe.—It appears from tables of mortality in the principal states of Europe that there dies annually 1 inhabitant out of 28 in the Roman States, and the ancient Venetian provinces; 1 in 30 in Italy in general, Greece and Turkey; 1 in 39 in Netherlands, France and Prussia; 1 in 40 in Switzerland, the Austrian Empire, Portugal and Spain; 1 in 44 in Russia in Europe and Poland; 1 in 45 in Germany, Denmark, and Sweden; 1 in 48 in Norway; 1 in 53 in Ireland; 1 in 58 in England, and 1 in 59 in Scotland and Iceland.

The Quadrant.—In 1734 it was said, "as soon as the common prejudice against new things is worn off, and the instrument is well known, I do not believe any ship will go on a long voyage without one of these excellent quadrants."

A French Mechanic.—M. Cavi was brought up a joiner. After serving in the army (what Frenchman is not a soldier?) he returned to Paris with a capital of 50 *cents.* He worked with a pattern maker during the day and in the evening took lessons in drawing; and as much of the night as could be spared from sleep worked upon the plans commenced in the drawing school. In 1823, he undertook the manufacture, in a small way, of steam engines, and in eight years had become possessed of stock in trade to the amount of one thousand dollars. After losing two-fifths of this by the failure of an individual connected in the way of business with him, he succeeded in recovering himself so far that in ten years he had manufactured 123 steam engines, the total nominal power being 2,835 horses. He has made recently an iron steamboat, navigating the lakes Neuchatel, Thorum, &c. His present establishment enables him to furnish a steam engine of 160 horse power in a month.—*Baron Dupin.*

Curious fact in relation to the Hedge-Hog.—It is stated on the authority of M. Lenz and Prof. Buckland, that the most virulent animal poisons have no effect on the hedge-hog, and further on the authority of a German physician that prussic acid, arsenic, opium, and corrosive sublimate were given to an animal of the species, without injurious effect.—*Arcana of Science,* 1835.

List of American Patents which issued in January, 1836.

		January
1.	*Water-proof silk hats.*—George B. Dexter, Boston, Mass.	6
2.	*Belt saw for timber.*—Benjamin Barker, Ellsworth, Maine,	6
3.	*Saw for felling trees.*—Walter Hunt, New York,	6
4.	*Cleaning clover seed.*—James Manning, Lambertsville, New Jersey,	6
5.	*Washing machine.*—Joab H. Hubbard, Bloomfield, Conn.	6
6.	*Cutting wooden screws.*—Joseph Peavy, Levant, Maine,	6
7.	*Dying hats.*—Aaron Gould, Washington, Conn.	11
8.	*Lock for doors.*—Solomon Andrews, Perth Amboy, N. J.	11
9.	*Cutting grain, &c., mill for.*—William Gerrish, Portsmouth, N. H.	11
10.	*Wharves, piers, &c.*—John G. Pray, Brooklyn, N. Y.	11
11.	*Napping machine.*—Stephen Marsh, Jericho, Vermont,	11
12.	*Drills for metal,* &c.—William R. Jones, Granville, N. Y.	11
13.	*Hanging wagons, &c.*—Henry Mellish, Walpole, N. H.	11
14.	*Planting corn.*—Charles R. Belt, Washington city,	15
15.	*Plough.*—John Dalkaner, Canton, Ohio,	15
16.	*Bedsteads.*—Jonas Maguire, Philadelphia,	15
17.	*Hydraulic cement.*—Levi Kidder, New York,	15
18.	*Wells, &c., covers of.*—Levi Kidder, New York,	15
19.	*Packing tobacco.*—J. B. Allen, Richmond, Va.	15
20.	*Ropes, &c., making.*—John Whiteman, Philadelphia,	15
21.	*Trunks, valises,* &c.—James W. Noble, Pittsfield, Mass.	15
22.	*Plough.*—Samuel Witherow, Gettysburg, Pa.	15
23.	*Stove, air-tight.*—Isaac Orr, Washington city,	20
24.	*Baker, reflecting.*—L. B. Olmsted, Binghampton, N. Y.	20
25.	*Grooves in corset rings, &c.*—Charles Buckland, Middletown, Conn.	20
26.	*Thrashing machine.*—Ebenezer Brown, Chenango, New York,	20
27.	*Horse power.*—Samuel Newton, Dayton, Ohio,	20
28.	*Propelling boats.*—Philander Noble, Westfield, Mass.	20
29.	*Plough.*—J. P. Chandler, and P. Ranger, Milton, Maine,	20
30.	*Saddles and collars.*—Ebenezer Hale, New York,	23
31.	*Hulling corn.*—Warren Carpenter, New Castle, Pa.	23
32.	*Force pump.*—Benjamin Egbert, Lansing, N. Y.	23
33.	*Stove-pipes.*—Ezra Ripley, Albany, New York,	23
34.	*Sulkey seat.*—O. H. Capron, and G. Barton, Jr., Shaftsbury, Vermont,	23
35.	*Packing flour.*—J. F. Barrett, Granville, N. Y.	23
36.	*Wooden bridges.*—Stephen H. Long, Topographical Engineer, U. S.	23
37.	*Hoes.*—Adna Allen, Ramapo, New York,	23
38.	*Trap for rats, &c.*—Thomas Neill, Herkersville, Ohio,	23
39.	*Hydraulic cement.*—John White, Syracuse, N. Y.	23
40.	*Horse collar.*—John Hopkinson, Warren county, Ohio,	23

CELESTIAL PHENOMENA, FOR MAY, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.	Sec.				
5	13	15		Im. a Sagittarii,	,5,6,	N. 140°	V. 102°
5	14	10		Em.		225	194
14	19	3	21	*Im. sun by moon,		320	265
14	20	13	26	N. App. centres,		212	158
14	21	32	33	Em. sun by moon,		104	55
20	8	44		Im. λ Cancri,	,6,	67	124
20	9	47		Em.		253	308
30	11	47		Im. A Ophinchi,	,4,5,	52	43
30	12	57		Em.		278	284

* For irradiation, 5″, and 12.1s. to time of beginning.
† " " subtract 15.1 from time of end.

Meteorological Observations for January, 1836.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.	Direction.	Force.		
				Inches	Inches			Inches.	
	1	17°	36°	29.90	29.90	W.	Moderate.		Clear day.
	2	28	47	.93	30.00	SW.	Calm.		Clear day.
	3	35	35	30.15	.20	E.	do.		Drizzle—cloudy.
	4	32	37	.2	.05	E.	Moderate.		Rainy day.
○	5	37	36	29.86	29.90	NE.	do.		Drizzle.
	6	31	31	30.13	30.24	E.	do.		Drizzle—cloudy.
	7	26	32	.11	.00	NE.	Brisk.		Cloudy—light snow.
	8	33	33	29.66	29.60	E.	Blustering	2.20	Rain.
	9	32	32	.50	.50	NE.	do.		Snow, 2 feet, drifted.
	10	27	30	.34	.34	W.	do.		Snow—cloudy.
	11	29	32	.54	.56	W.	Moderate.		Snow—clear.
☾	12	30	35	.70	.75	W.	do.		Clear day.
	13	32	40	.86	.94	W.	do.		Clear—cloudy.
	14	33	49	.96	30.00	W.	do.		Clear day.
	15	25	32	30.05	.05	W.	do.		Clear day.
	16	11	23	.15	.20	NW.	do.		Clear—lightly cloudy.
	17	14	27	29.90	29.76	NE.	do.		Snow—sleet.
	18	24	32	.50	.50	W.	do.		Sleet—cloudy.
⊗	19	21	29	.95	.95	W.	do.		Clear—lightly cloudy.
	20	11	25	30.10	30.15	W.	do.		Clear day.
	21	10	31	.20	.15	SE.	do.		Cloudy—lightly cloudy.
	22	36	40	29.70	29.70	W.	do.		Rain—lightly cloudy.
	23	16	24	30.00	30.10	NW.	do.		Clear day.
	24	9	26	.40	.45	NW.	do.		Partially cloudy—sleet, with snow
☽	25	25	30	29.53	29.60	NW.	Blustering.		Snow—clear.
	26	17	31	.91	.90	SW.	Moderate.		Cloudy—lightly cloudy.
	27	7	20	.96	.96	W.	do.		Clear day.
	28	1	11	30.00	30.03	W.	do.		Clear day
	29	3	23	.00	.03	W.	do.		Clear day.
	30	17	32	29.90	29.90	WSW.	do.		Lightly cloudy.
	31	34	32	.60	.54	SSW.	do.		Snow.
	Mean	22.68	31.39	29.90	29.90				

	Thermometer.	Barometer.
Maximum height during the month,	49. on 14th.	30.45 on 24th.
Minimum do.	1. on 8th.	29.34 on 10th.
Mean do.	29.90	

In consequence of an accident which happened to the rain gauge, no estimate could be made of the quantity fallen since the 8th of January.

JOURNAL

OF THE

FRANKLIN INSTITUTE

Of the State of Pennsylvania,

AND

MECHANICS REGISTER;

DEVOTED TO

Mechanical & Physical Science,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1836.

Practical and Theoretical Mechanics.

Report of Experiments made by the Committee of the Franklin Institute of Pennsylvania, on the Explosions of Steam-Boilers, at the request of the Treasury Department of the United States.

(*Continued from page* 233.)

XII. *On the elastic force of steam at working pressures.*

The committee, determined to put the apparatus which was necessary for other experiments, to the best use possible, in determining the elastic force of steam at different temperatures; and accordingly great pains were bestowed upon the graduation of the gauge, the regulation of the temperature of its parts, &c., the comparison of the thermometers, the maintenance of the scales at about the same temperature, &c.* The small size of the boiler, and the various openings required to be made in it for the experiments which were the immediate objects of the committee, were unfavourable to the attainment of considerable pressures, but the discrepancies, even at working pressures, of the different tables of the elastic force of steam, made it important to push those trials as far as could be done without material changes. They succeeded without much difficulty in reaching ten atmospheres, which is but one atmosphere less than the reputed working pressure of our high pressure engines, and as the experiments on the safety valves have rendered probable, is very near the true working pressure.

---

* See description of apparatus, &c., pp. 2, 3, 4, &c.

A series of results obtained in the trials of the fusible plates, is given below in the tabular form.

The table contains the temperature observed by the thermometer in the water, corrected for the error of the graduation; the temperature of the scale of the thermometer, with a view to show, that it was not allowed to vary too considerably; the observed height of the mercury in the gauge, reduced to its mean height; the temperature of the air in the gauge; its volume at the observed temperature; the volume reduced to 48°, the temperature of graduation of the gauge at which the column of mercury, equivalent to an atmosphere, is very nearly 30 inches; the elasticity of the compressed air, in inches of mercury; the correction in the height of the column of mercury, for the depression produced in the cistern below; the height thus corrected; the height after subtracting the sensibly constant number for the column of water between the level of the steam pipe from the boiler and the cistern of the gauge; the total elasticity in inches of mercury; the elasticity in atmospheres. The first number in the table is merely introduced for the convenience of presenting certain data required for subsequent calculation, it gives the height of the mercury in the gauge before beginning the observations, after correcting for the height of the barometer.

TABLE No. I. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of Steam.	Temperature of scale of ther.	Height of air gauge.	Temperature of air in gauge.	Vol. of air at observed temp.	Vol. of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height + .01 height.	Height + .01 height — 1.29 inches.	Total elasticity in inches of mercury.	Elastic force in atmospheres of 30 inches.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches.	Inches.	Inches.	Inches.	Inches.	Atmos.
		3.99*	62	8.33	8.101	27.26	.04	4.03	2.74	30.00	1.00
262¼	63	15.04	74	3.93	3.737	59.09	.15	15.19	13.90	72.99	2.43
268½	71	16.34	,,	3.43	3.259	67.76	.16	16.50	15.21	82.97	2.76
275½	,,	17.34	,,	3.05	2.898	76.20	.17	17.51	16.22	92.42	3.08
286½	,,	18.94	,,	2.44	2.319	95.23	.19	19.13	17.84	113.07	3.77
296½	,,	19.94	,,	2.05	1.948	113.36	.20	20.14	18.85	132.21	4.41
298½	73	20.11	,,	1.99	1.891	116.76	.20	20.31	19.02	135.80	4.53†
302	,,	20.44	,,	1.86	1.767	124.98	.20	20.64	19.35	144.33	4.81‡
305½	76	20.79	75	1.73	1.641	134.57	.21	21.00	19.71	154.28	5.14
313¼	79	21.39	,,	1.50	1.422	155.30	.21	21.60	20.31	175.61	5.85§
317¾	80	21.64	,,	1.405	1.332	165.79	.22	21.86	20.57	186.36	6.21
320¾	,,	21.79	76	1.347	1.275	173.20	.22	22.01	20.72	193.92	6.46
327¾	,,	22.24	,,	1.176	1.113	198.41	.22	22.02	20.73	219.14	7·30
333¾	,,	22.69	,,	1.004	0.950	232.46	.23	22.92	21.63	254.09	8.47

* This observation shows the height of the gauge before the experiment, corrected for the height of the barometer.

† Mean of 4 observations. ‡ Mean of 2 observations. § Mean of 2 observations.

A curve traced to represent these observations, the ordinates representing the pressures, and the abscissæ the temperatures, is quite regular, until the temperature corresponding to eight atmospheres is attained, when it rises abruptly. This fact was explained by examining the gauge; it was found that the cement used in attaching the glass tube to its ferule had become softened and had permitted the tube to rise. This defect was remedied and its recurrence prevented. It was then determined to repeat the entire series of observations, and to carry them as high as could be done, with reasonable convenience, aiming particularly, to embrace the range of working pressures of the American engines.

The results are contained in the following table, in which the observed data, and calculated numbers, are arranged as in the last table. This table extends to 9.91 atmospheres and to the temperature of 352° Fah.

Care was taken that the elasticities were increased not too rapidly, and the last numbers obtained, were verified by keeping the temperature sensibly constant for a considerable time.

TABLE No. II. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of steam.	Temperature of thermometer scale.	Height of mercury in air gauge.	Temperature of air of gauge.	Volume of air at observed temperature.	Volume of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height + .01 height.	Height + .01 height — 1.29 inches.	Total elasticity in inches of mercury.	Elastic force in atmospheres of 30 inches.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches.	Inches.	Inches.	Inches.	Inches.	Atmos.
		5.56*	48	7.695	7.695	25.67	.06	5.84	4.55	30.00	1.00
248¼	54	14.04	53	4.32	4.277	46.19	.14	14.18	12.89	59.08	1.97
269½	—	17.34	52	3.05	3.026	65.29	.17	17.51	16.22	81.51	2.72
284½	—	19.64	,,	2.17	2.152	91.76	.19	19.83	18.54	110.30	3.68
289½	—	20.06	,,	1.99	1.974	100.05	.20	20.26	18.97	119.02	3.97
294½	—	20.56	53	1.82	1.802	109.63	.21	20.77	19.48	129.11	4.30
299½	—	21.04	54	1.63	1.611	122.66	.21	21.25	19.96	142.62	4.75
304½	—	21.34	54½	1.52	1.500	131.66	.21	21.55	20.26	151.92	5.06
310¼	—	21.64	,,	1.405	1.382	142.94	.22	21.86	20.57	163.51	5.45
314¾	58	22.04	55	1.25	1.233	160.26	.22	22.26	20.97	181.23	6.04
319¾	—	22.34	55½	1.14	1.124	175.86	.22	22 56	21.27	197.13	6.57
329¾	—	22.84	56	0.95	0.937	210.84	.23	23.07	21.78	232.62	7.75
334½	66	22.94	57	0.92	0.904	218.60	.23	23.17	21.88	240 48	8.02
338¾	—	23.04	57½	0.887	0.870	226.92	.23	23.29	22.00	248.92	8.30
345	—	23.24	,,	0.82	0.805	245.44	.23	23.47	22.18	267.62	8.92
348	—	23.34	58	0.787	0.771	256.05	.33	23.57	22.28	278.33	9.28
350	—	23.44	,,	0.752	0.737	267.97	.23	23.67	22.38	290.35	9.68
352	—	23.50	,,	0.733	0.719	274.92	.23	23.73	22.44	297.36	9.91
346	—	23.28	62	0.807	0.785	251.78	.23	23.51	22.22	274.00	9.13

* This observation shows the corrected height of the gauge before the experiments.

There is one observation, namely, that at 329¾°, which is certainly recorded erroneously; but omitting this one, the rest which are given, present a very tolerable regularity in the curve traced to represent them. For the sake of adding to the force of these results the scattered observations of temperatures and pressures incidentally made during the other experiments of the committee, are brought together in the annexed table.

A column is added to the table, to show the number of observations employed in obtaining the results.

Table No. III. *Of the Elastic Force of Steam at different Temperatures.*

Temperature of steam.	Temperature of thermometer scale.	Height of mercury in air gauge.	Temperature of air in gauge.	Volume of air at observed temperature.	Volume of air at 48° Fah.	Elasticity of air in inches of mercury.	.01 height of gauge.	Height of gauge + .01 height.	Height + .01 height — 1.29 inches.	Elasticity of steam in inches of mercury.	Elastic force in atmospheres.	No. of observations.
Fah.°	Fah.°	Inches.	Fah.°	Vols.	Vols.	Inches.	Inch	Inches.	Inches.	Inches.	Atmos.	
		3.91*	59	8.35	8.169	27.34	.04	3.95	2.66	30.00	1.00	
234	54	8.80	55	6.39	6.301	35.45	.09	8.89	7.60	43.05	1.43	1
239¼	62	9.94	61	5.94	5.788	38.59	.10	10.04	8.75	47.34	1.58	,,
245¼	68	11.16	63	5.46	5.300	42.14	.11	11.27	9.98	52.12	1.74	5
250¼	70	12.54	63	4.92	4.776	46.77	.12	12.66	11.37	58.14	1.94	4
256¼	73	13.88	64	4.38	4.243	52.64	.14	14.02	12.73	65.37	2.18	5
262¾	77	15.14	64	3.89	3.768	59.27	.15	15.99	14.00	73.27	2.44	2
271	70	16.34	65	3.43	3.316	67.35	.16	16.50	15.21	82.56	2.75	4
278	75	17.44	70	3.01	2.882	77.49	.17	17.61	16.32	93.81	3.13	3
288¼	75	18.74	68	2.50	2.403	92.94	.19	18.93	17.64	110.58	3.69	3
291	76	19.14	65	2.36	2.282	97.88	.19	19.33	18.04	115.92	3.86	2
292½	65	19.44	63	2.25	2.184	102.26	.19	19.63	18.34	120.60	4.02	3
300	73	20.12	65	1.98	1.914	117.33	.20	20.32	19.03	136.36	4.55	4
303½	74	20.54	66	1.82	1.756	127.27	.20	20.74	19.45	146.72	4.89	1

* This observation shows the corrected height of the gauge before the experiments.

This table enables us to go as low as 1.43 atmospheres, and is strikingly accordant with the two others as far as they extend in common.

A curve which would be traced by the following table, which may be considered to represent the mean of the foregoing, would differ little more than one-tenth of an atmosphere in any part of the range, from the observations, omitting one noticed in the first, and another noticed in the second table; the pressures in general differing less than one-tenth of an atmosphere from the observed pressures.

Table *of the Elastic Force of Steam, from one to ten Atmospheres.*

Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.	Pressure.	Observed Temp.
Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°	Atmos.	Fah.°
1	212	3	275	5	304½	7	326	9	345
1½	235	3½	284	5½	310	7½	331	9½	349
2	250	4	291½	6	315½	8	336	10	352½
2½	264	4½	298½	6½	321	8½	340½		

To compare our results with those given by the committee of the French Academy, we have traced, on Plate 5, a curve, from the above table, and another from those of the thirty observations, selected by the committee of the Academy, from their experiments, below ten atmospheres. The curve of our observations, passes at low pressures nearer to the line AB than that of the French experimenters, and after coinciding at the medium pressures of the table, crosses the latter, differing at ten atmospheres 5 degrees, or at 352½ degrees .65 of an atmosphere. The curve of our observations is traced in a full line, that of the French Academy is dotted.

The difference here noticed is too considerable to be admitted, as within the limits of errors in the apparatus or in observation. Having an authority of so much weight against them, the committee have been driven to examine their results very closely. The care employed in the graduation of the gauge seems to exclude the idea of error from it; the upper portion of the scale was divided to .05 of an inch, and could easily be read to half of that distance, making about .1 of an atmosphere at the highest pressure attained. A specific correction for capillarity was ascertained and employed. In one point of manipulation, namely, the method employed to dry the air, the committee differed from what was usual, and though they think there is reason to confide in that method, they have examined what effect would be produced if the air were saturated with moisture. Recent experiments, on the passage of gases, out and into vessels placed over mercury, and observations connected with them, warrant, moreover, a suspicion that dry air standing in a glass vessel over mercury, the surface of which covered by water, may become impregnated with vapour. The effect of such a source of error they have calculated[*] in the highest and lowest results of table No. II. and find it to be as follows:

For 248¼° the tension of the vapour is 1.96 instead of 1.97, and
,, 352 ,, 9.78 ,, 9.91.

Differing from the numbers given in table No. II. by .01 and .13 of an atmosphere.

This supposition is thus shown to be inadequate to explain the discordance, and must, in fact, be deemed, to a certain extent, gratuitous.

The committee have next compared the results furnished by the safety-valves graduated independently of the gauge, and these, as has already been shown, gave calculated pressures four per cent. and ten per cent. higher than the pressures indicated by the gauge. From these independent experimental data we have then an evidence that our results are, probably, not too high.

---

[*] If v be the volume of moist air and v', that of the dry air corresponding to it, e the elasticity of the air when expanded by the moisture, and e' of the dry air equivalent in elastic force to the mixture, and t be the tension of the vapour in the air, then the volume of the air being increased by the presence of the moisture, and the elasticities being inversely as the volumes.

$$e : e' :: v' : v, \text{ whence } v' = \frac{e\,v}{e'}$$

$$\text{but, } e = e' - t, \text{ whence } v' = v - \frac{v\,t}{e'}$$

This equation is true at all pressures if we suppose the space originally to be saturated with moisture; for as the space becomes less, a portion of the vapour will be converted into water. The value for e' may be derived in any assumed case from Table II. page 78.

To apply these remarks. From the first line of Table No. II. we have

$$v = 7.695,\ e' = 25.67,$$

and from Mr. Dalton's experiments, t corresponding to 48°, is .35 of an inch.

$$\text{whence } v' = 7.695 - \frac{7.695 \times .35}{25.67}, \text{ or}$$

$$v' = 7.495$$

For 248¼°, Table No. II. gives $v = 4.32$, $e' = 46.19$, and the temperature 53°, whence $t = .41$ and $v' = 4.28$ at 53°, and the elastic force of the steam is 1.94 atmospheres.

In like manner for 352°, $v' = 0.732$ at 58° and the first result for v, that at 48°, which gives 7.495 volumes, makes the corresponding pressure 9.78. This number differs but .13 of an atmosphere from that in the table.

The question of the elastic force of steam has been examined by many experimenters, and with very various results. The committee propose to show the state of knowledge on the subject by comparing the principal series of experiments referring to temperatures above 212°, with their own, which are now under examination. In the first table, below, they have compared their results with those of Robison,* of Ure,† and of Taylor‡.

The first two experimenters named, used an open mercury gauge in their experiments, and the thermometers were exposed to the pressure of the steam. This latter circumstance would tend to render the observed temperature slightly too high, or the observed pressure, relatively to the temperature, too low, as far as it produced any effect.

Elastic Force of Steam in Atmospheres.

Temp. of steam in degrees Fah.	Committee of Franklin Institute.	Prof. Robison.	Difference.	Dr. Ure.	Difference.	Mr. Taylor.	Difference.
212°	1.00	1.00	.00	1.00	.00	1.00	.00
240	1.64	1.83	—.19	1.72	—.08		
250	2.00	2.23	—.23	2.06	—.06	1.97	+.03
260	2.35	2.68	—.33	2.41	—.06	2.34	+.01
270	2.74	3.14	—.40	2.88	—.14	2.75	—.01
280	3.25	3.53	—.28	3.40	—.15	3.26	—.01
290	3.89			4.00	—.11	3.82	+.07
300	4.60			4.66	—.06	4.46	+.14
310	5.50			5.38	+.12		
320	6.40					5.98	+.42

The experiments of Watt are not referred to, as he states himself, that he has doubts of their accuracy, and defers to the results of Mr. Southern, which will be given presently.

The results of the committee, as to pressure corresponding to temperature, all fall below those of Professor Robison, the extremes being .14 and .40 of an atmosphere, they approach nearer to those of Dr. Ure, differing in the extremes — .06 and + .12 of an atmosphere. They agree even more nearly with the experiments of Mr. Taylor, tending, generally, to gain upon them; thus at 260° the difference is .01 of an atmosphere, and at 320° is .42. The temperature corresponding to six atmospheres, in the table of the committee, is 315½°, to the same (5.98) in that of Mr. Taylor, 320°, and to the same in that of the French commission, 320.4, the latter two agreeing very closely.

In the following table are given a comparison of the experiments of the committee, with those of Mr. Southern,§ Professor Arzberger,|| of Vienna, and the Commission of the Academy of Paris.¶ The pressures were obtained in the experiments of Mr. Southern, by a piston valve, which is stated to have been checked, in part, by a mercury gauge; in the experiments of Professor Arzberger by a spherical valve of steel; and in those of the French commission, by a closed gauge, containing air. The numbers for these last named re-

---

* Robison's Mech. Philos. vol. ii.

† Phil. Trans. 1818.

‡ Phil. Mag. vol. ix.

§ Robison's Mech. Philos. vol. ii.

|| Tredgold on Steam Engine, quoted from Bull. Sc. Tech. vol. i.

¶ Annales de Chim. et de Phys. vol. 43.

sults are those deduced from the empyrical formula adopted as representing, most closely, the experiments.

Pressures in atmospheres.	Temperatures.						
	By experiments of Com. of Frank. Inst.	By Mr. Southern.	Difference.	By Prof. Arzberger.	Difference.	By Commission of French Academy.	Difference.
	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°	Fah.°
1	212						
2	250	250.3	—0.3	249*	+1.0	250.5	—0.5
3	275			274†	+1.0	275.2	—0.2
4	291½	293.4	+1.9			293.7	—2.2
5	304½					308.8	—4.3
5.87	314¼			322	—7.7	318 8	—4.5
6	315½					320.4	—4.9
7	326					331.7	—5.7
8	336	343.6	—5.6			342.0	—6.0
9	345					350.8	—5.8
10	352½					358.9	—6.4
10.83				372		362.8	

* 1.97 atmospheres. † 2.96 atmospheres.

From these comparisons it appears that for given temperatures the pressures determined by the committee, are lower than those found by Professor Robison, between 1 and 3½ atmospheres; lower than those of Dr. Ure, from 1 to 5⅓ atmospheres, except at the highest pressure, differing, however, but little from them; nearly the same from 1 to 2¾ atmospheres with those of Mr. Taylor, and higher from 2¾ to 6 atmospheres; higher than those of Mr. Southern; much higher than those of Professor Arzberger; higher than those of the French Commission.

The temperature given by the committee for the pressure of 8 atmospheres differs about 3° from that inferred from the temperature given by Christian* for 7.8 atmospheres; viz. 337° Fah.

The empyrical formula, adopted by the committee of the French Academy, as representing the law of relation between the pressure and temperature of steam, is of the form.

$$e = (a + nt)^{5}$$

Where e represents the elastic force of the steam, t the temperature, and a and n are constants, determined as well as the index, 5, from observation.

Tredgold had previously adopted a formula similar to this, in form, as agreeing nearly with the best experiments, to which he had access, and which have already been compared with the results obtained by this committee. Of this formula the French Commission remark, that the numbers which it gives, accord at the lower temperatures of their series, better with their experiments than those furnished by their own formula. Besides the differences in the numerical coefficents between the two formulæ now in question, Tredgold's formula has the number six instead of five for an index. In other words the elasticity increases more rapidly with the temperature than would be shown by the formula written on the preceding page.

---

* Quoted by Mr. Ivory, from Mech. Indust. vol. ii.

With this law the experiments of the committee coincide; the index six applying much more nearly to their results than five. The empyrical formula adopted to represent their results is

$$e = (.00333\ t + 1)^{6}$$

where e is the elasticity of the steam in atmospheres, and t the excess of temperature above the boiling point of water in degrees of Fahrenheit's scale.

This formula will be found to accord very well at the higher pressures with the experiments of this committee, and its variations from them at other pressures to be sometimes in excess, and at others in defect.

This will appear by calculating the values of t* for the different pressures recorded in the table of the committee, on page 292, and comparing them with the numbers found by experiment.

Comparison of Temperatures calculated by the Formula, with those deduced from Experiment.

Elastic force.	Calculated temp.	Temp. by exper.	Difference.	Elastic force.	Calculated temp.	Temp. by exper.	Difference.
Atmos.	Fah.°	Fah.°	Fah.°	Atmos.	Fah.°	Fah.°	Fah.°
1	212.0	212	0.0	6	316.5	315⅑	+1.0
2	248.8	250	—1.2	7	327.3	326	+1.3
3	272.3	275	—2.7	8	336.4	336	+0.4
4	290.1	291½	—1.4	9	344.8	345	—0.2
5	304.4	304½	—0.1	10	352.5	352½	0.0

The comparison indicates that at the lower temperatures, the elasticity, as shown by the formula increases too rapidly, but from four up to ten atmospheres, the differences between the calculated and mean temperatures are less than one degree and a half of Fahrenheit's scale. The differences have sometimes the positive and sometimes the negative sign, which is favourable to the correctness of the formula as representing the law of increase of elasticity, in terms of the temperature.

In conclusion, it seems to the committee, that while the differences in the results of experimenters are greater than the present state of experimental science warrants, yet at pressures even exceeding ordinary working pressures, the relation of the temperature and pressure of steam may be considered, in a practical point of view, as sufficiently determined.

---

* The formula gives, $t = \frac{e^{\frac{1}{6}} - 1.}{.00333}$, or

$$\text{Log. } t = \text{Log. } (e^{\frac{1}{6}} - 1) - \text{Log. } .00333.$$

Presented to the Board of Managers of the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, and approved.

ISAAC HAYS,
Chairman Board of Managers.

Attest,
William Hamilton, *Actuary.*

Philadelphia, January, 1836.

We append to the foregoing report of the Committee on Explosions, a document which appears in the authorized copy of the report as a preface, and which contains an account of the transactions of the Committee.

Com. Pub.

PREFACE.

The Committee, whose report of experiments, made by the request of the Secretary of the Treasury of the United States, is presented in the following pages, was appointed on the 10th of June, 1830, for the purposes expressed in the annexed resolution of the Board of Managers of the Franklin Institute, of the State of Pennsylvania, for the promotion of the Mechanic Arts.

"*Resolved*, That a committee of seventeen members be appointed, to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects."*

The Committee consisted of the following named members of the Institute.

Alex. D. Bache, *Chairman.*

Robert Hare, M. D.	J. K. Mitchell, M. D.
S. V. Merrick,	Benjamin Reeves,
W. H. Keating,	George Fox,
Isaiah Lukens,	Thomas P. Jones, M. D.
James J. Rush,	W. R. Johnson,
James Ronaldson,	M. W. Baldwin,
Frederick Graff,	James P. Espy,
R. M. Patterson, M. D.	George Merrick.

Immediately after their appointment, the Committee addressed a circular letter to persons, whom they supposed would be able to give information, in regard to the explosions of steam-boilers which had occurred in our country, or abroad, and of which no accounts had been previously published. They took, also, other means to inform themselves on the subject referred to them.

The information derived from replies to the circular has already been made public.†

While the Committee were engaged in the inquiries necessary to enable them to report to the Managers of the Franklin Institute, a letter was received by that body from the Secretary of the Treasury of the United States, informing them that funds had been placed, by the House of Representatives, at the disposal of the department, for inquiries in regard to the explosions of steam-boilers, and inviting experiments on the subject, by the Institute, at the expense of the Treasury Department.

A series of questions, connected with the probable causes of explosion, or with theories which have been offered in relation to them, and with the safety of the steam engine, was submitted to the Secretary of the Treasury, with a plan of experiment based upon the queries, and an estimate of the cost of the experiments. This plan was approved, and authority given to add to the original subjects proposed for investigation, any others which might suggest themselves in the course of the experiments; the amount to be expended being, however, limited.

---

* This resolution was moved by W. H. Keating, Esq., who subsequently declined the chair of the Committee, and Prof. A. D. Bache was chosen chairman

† Journal Franklin Institute, vols. viii., ix., and x.

In order to carry on the experiments, the following sub-committees were appointed.

1. On the experiments,* excepting those relating to the strength of iron and copper.

Messrs. A. D. Bache,	M. W. Baldwin,
Benjamin Reeves,	S. V. Merrick,
W. H. Keating,	Isaiah Lukens.

2. On the strength of iron and copper used for steam-boilers.†

Messrs. W. R. Johnson,
A. D. Bache,
Benjamin Reeves.

The first of these sub-committees presented the report of their experimental investigations, which, having been examined by the Committee, was finally adopted on the 23d of December, 1835, and ordered to be submitted, through the Managers of the Institute, to the Secretary of the Treasury.

The labours of the second sub-committee, as well as a report on the subjects in relation to which the Committee was appointed, yet remains to be presented.

It was deemed proper to delay such a report, until all the light which the experiments could afford, had been shed upon the important and intricate subject referred to the Committee.

On behalf and by direction of the Committee, &c.

Alex. Dallas Bache, *Chairman.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Account of the Explosion of the Boiler of the Steamboat Wm. Gibbons. By Thomas Ewbank, of New York.‡

This explosion occurred on Thursday morning, January 21st, as the boat was entering this harbour, on her return from Charleston, (S. C.) By this melancholy disaster, six lives have been lost.

The Wm. Gibbons has but one boiler, made of wrought iron, and similar in its construction to those of the "Ohio," and "New England," but having a greater number of horizontal flues. These terminate, as in the boilers of those boats, in a large vertical flue, which passes through the roof of the boiler. It was this flue which was collapsed. The following memoranda were made by me on different visits to the boat.

January 24. I visited the Wm. Gibbons this day. The chimney proper, or smoke pipe, (represented by the dotted lines, *a*, *a*, in the annexed sketch, Plate 7, Fig. 1,) had been removed. Upon looking down, the collapse was quite obvious. The flue was pressed together, so as to be closed almost entirely at the part where the rent had taken place. A section of that part is represented at F. Fig. 2, exhibiting a three cusped figure, instead of that of a circle, its original form. As the flue was still enclosed in the case B, the precise situation of the rent with respect to the surface of the water in the boiler, could not then be accurately ascertained without entering the boiler. The collapsed flue is made of quarter inch iron, and is three feet in diameter. A space of seven inches is left between it and B. The steam pipe, S, is connected to the latter at its upper end, which is eight feet above the roof of the boiler.

---

* This sub-committee had the subjects referred to them on the 1st of November, 1830.

† Appointed January 4th, 1831.

‡ This interesting account was addressed to the Committee on Explosions, in consequence of a request made to Mr. Ewbank by a member of that Committee. We feel persuaded that if intelligent men at the different places near which explosions occur, would take pains to ascertain the nature of the effects, and make public the results of their examinations, the cause of humanity would be essentially served. It will be seen that Mr. Allaire, the maker of the boiler of the Wm. Gibbons, has set a most praiseworthy example, by affording every facility for examining the effects of the explosion.
Com. Pub.

January 26. This day B was removed, leaving the ruptured and vertical flue, C in the sketch, fully exposed to view. The rent, R, was four inches above the roof of the boiler. It was in one of the horizontal seams, and confined almost wholly to it; it extended nearly three feet, or about one-third of the circumference. The line of separation was through the centre of the rivet holes, nearly the whole extent, a strip of metal thus separated being left in its place, in the lower portion of the flue. The iron is cracked in some places, where the flexure has been greatest, as at O.

Through the politeness of James P. Allaire, Esq., the builder of the engine and boiler, and also one of the owners of the boat, I have obtained a portion of the ruptured flue, which is sent with this communication. It is from one end of the rent. The thickness of the metal at the part ruptured is not sensibly diminished, as will be perceived by the specimen sent. The question of the deterioration of the metal by heat, may perhaps be determined by it also.

The original cause of this explosion is conceived to be identical with that of the Ohio,* and is to be found in the "construction of the boiler," the arrangement of the flues in it being such that the principal one, (that which collapsed,) could not be protected by the water. Its exposure to high degrees of temperature, under these circumstances, must necessarily diminish its strength very materially. The increase of its temperature is also accompanied with an increased elasticity of the steam; hence its power of resisting the pressure around it diminishes as that power is augmented.

In addition to the remarks made on these flues in the case of the Ohio, it may be further observed, that, from their greater dimensions compared with the horizontal ones, their strength necessarily bears no comparison with that of the latter, even if covered, like them, with water. How much more liable to destruction, then, are they, wholly unprotected by it? The horizontal flues of the Wm. Gibbons do not exceed twelve inches in diameter; the ruptured flue, as before observed, is thirty-six inches.

If steam chimnies are deemed indispensable, would it not be safer to convey each horizontal flue separately through the roof of the boiler, than to combine them all in the large one in question?

The surest remedy, however, is to make all interior flues terminate outside of the boiler, *below* the water line. Neither this explosion, nor that of the Ohio, could have occurred, if such had been the arrangement in their respective boilers.

The immediate cause of the explosion is attributed, and no doubt justly, to the imprudence of the second engineer, and two of the firemen,† in wantonly urging the fire with quantities of wood, (anthracite coal being the principal fuel used,) and thus unnecessarily, at that time, increasing the force of the steam, and the heat of the vertical flue, against the positive and repeated directions of the chief engineer, who was very unwell at the time. It appears that one or more of them ridiculed the apprehensions of that officer, while in this act of disobeying his orders. His reasons for giving such directions are not left to conjecture, when we learn that, off Cape Hatteras, he had discovered that the vertical flue was pressed inwards, in one place, although but slightly. This is the fact referred to by one of the passengers, (Mr. Newmark,) in the statement which follows. The *repairs* done to the boiler, near Cape Hatteras, were in consequence of a leak near one of the fire doors.

---

* See this Journal, vol. x., p. 226, Ewbank on the Explosion of the Steamboat Ohio. The effects on the boiler, in that case and this, are strikingly similar. Com. Pub.

† They were all killed.

The engine and boiler were considered in good repair; there was no design to repair either previous to the next trip, as has been stated in some of the papers. The only alterations contemplated were in the paddles, which they are now undergoing.

The following statement of a number of the passengers who were on board of the William Gibbons, was published just subsequent to the explosion.

To the Public.

The undersigned, passengers on board the steam packet Wm. Gibbons, on the occasion of her late disastrous trip from Charleston to this port, convinced that no adequate account has yet been given to the public of the circumstances connected with the explosion, by which six unfortunate individuals were hurried away in all the vigour of life, feel it to be their duty to submit to the community a concise statement of certain facts within their personal knowledge. Events so calamitous, however great the individual anguish of which they are the occasion, may, nevertheless, be the source of some public good; but this good can spring only from a developement of all their attendant circumstances, to such an extent that they may constitute a warning and a lesson for the future.

The Gibbons left Charleston on the morning of Sunday, the 17th of January, at 10 o'clock. On Monday, about sunset, she passed Cape Hatteras. Not long afterward, the engine was stopped, the fires extinguished, and the water discharged from the boiler. The whole night was consumed in repairs, with the precise nature of which we were, at the time, unacquainted. The inquiries of the passengers failed to elicit any satisfactory information; there seemed, indeed, to exist a studied determination, on the part of those in authority on board, to avoid making any disclosures.

After this time we carried very low steam, the gauge rod not standing generally higher than seven, eight, or nine inches. Before reaching Cape Hatteras, it had stood usually at fifteen, sixteen, or eighteen. Being in plain sight, it was frequently noticed, for many of the passengers were suspicious of our danger, and mentioned their apprehensions repeatedly.

On Thursday morning, it was remarked that we were again carrying heavy steam, a circumstance which had not been before observed since the occurrence at Cape Hatteras. A gentleman who was standing near the steam chimney, for the purpose of warming himself, called the attention of another to the fact that the rod stood at fifteen inches. This was mentioned to several, who observed that our speed indicated high pressure. These gentlemen believe that not more than ten or fifteen minutes had elapsed after this observation, before the explosion took place. In order, however, to be perfectly safe, they are willing to testify that the time was not greater than half an hour; our speed, meanwhile, by no means indicating a diminished power. Let this be compared with the statement which has been given to the public, that, at the moment of the accident, the rod stood at nine inches. At the *very* moment of the accident, what was the pressure, Heaven only knows; but that an explosion could have taken place from the expansive force of steam at a pressure of nine inches, in less than half an hour after a pressure of fifteen had been endured without accident, is a supposition not remarkably plausible.

On the morning of Thursday, the day of the accident, between one and two o'clock, the first engineer was heard to caution his assistant, to whom at that hour he committed the charge of the engine, against getting up the steam too high, making use of the expression, "she will not bear (or carry) much steam." An unusual sound was soon after heard, described by a passenger as resembling the wheezing of a wind-broken horse, which was believed to be occasioned by the escape of steam through an irregular channel. After daylight another sound was noticed, like what might be occasioned by the dripping of water upon coals. It may be inquired whether this sound did not attract the attention of the captain himself, when in the forward cabin, between seven and eight o'clock in the morning, and whether he did not then approach the end of the boiler to ascertain the cause.

The undersigned choose not to allude to matters of common belief in the community, but to which their personal knowledge does not extend. They are persuaded, however, that a judicial investigation would demonstrate that the boiler of the Wm. Gibbons had been deemed unsafe antecedently to this last unfortunate trip, and the accident we have now to deplore, was not the first intimation of its insecurity received by the owners. If it be true that the Gibbons was not intended for another trip before receiving repairs, the fact ought to be known. This boat was sent out in the room of the Columbia, which had been advertised at the other end of the line, but was not despatched, in consequence, it is said, of the incompleteness of her preparations.

The object of the undersigned is not to inculpate any one; if blame is any where due, the public, in view of the circumstances, will apply it to the right quarter. If no one is blameable, the facts will show this likewise: and the statement now made, being truth, and nothing but the truth, will acquit of groundless suspicion all who might otherwise suffer.

In cases like the present, where human life is endangered, or destroyed, too much light cannot be thrown upon the causes; too great watchfulness cannot be exercised to vindicate those, through whose instrumentality, though it be indirect, though it be but an error of omission, or of carelessness, the happiness of families is thus broken up, and the hearts of parents, of sisters, and of relations yet more near, are wrung with anguish.

It was not the original intention of the undersigned to make any public statement on this subject. The imperfect statements which have appeared in regard to it, have, however, induced them to the present course. The passengers of the Gibbons are now, in a great measure, dispersed. The names which follow, are those of all whom it has been found practicable to see.

Frederick A. P. Barnard,	New York.
James M‘Dowall,	Augusta, Ga.
C. B. Seymour,	Roanoke, Ga.
Samuel K. Tallmadge,	Augusta, Ga.
O. E. Carmichael,	" "
Robert D. Hamlim,	" "

D. B. Nafew,	New York.
William Swift,	"
John F. M'Kinne,	"
Robert Cochrane,	"
Isaac Sniffen,	"
Charles Elms,	Charleston, S. C.
Joseph Newmark,	84 Murray street, New York.
E. Robbins,	New York.

The following fact, in addition to the above, may be stated by the subscriber. On Monday afternoon, before the occurrence at Cape Hatteras, I observed one of the engineers to open the sheet-iron door looking into the steam chimney, and afterwards to go down, and return in company with the other. After examining it together, one remarked to the other, "I think there will be no danger till we get to New York." This fact I stated to the coroner's jury on the body of Mr. Davega, in the presence of the captain and first engineer.

Joseph Newmark,
84 Murray street.

It is but fair to state, before concluding these remarks, the alleged advantages of steam chimnies. The following experiment is furnished by Mr. Allaire, as a case in point. His extensive experience, and long practice, together with the great facilities he possesses in his establishment for experimenting on a large scale, entitle his views to more than ordinary consideration.

A common boiler was found to generate steam so very slowly as to be almost useless; it was with difficulty that the steam could be maintained in it at seven pounds to the inch. A steam chimney was afterwards adapted to it, when the steam was with less trouble kept up to fifteen pounds.

It is said that there is no danger in steam chimnies, provided the steam is permitted to escape through the safety valve, which is placed on the steam pipe, *whenever the engine is not in motion*, as when the boat is in the dock, previous to starting, &c. The object of this is, to prevent the vertical flue above the surface of the water becoming unduly heated, for the steam, by passing up round it, carries off the caloric from its surface, and thereby tends to keep its temperature at the same range as that of the steam, or nearly so. The great source of the destruction of these flues, is said to be the neglect of this precaution. Some have been destroyed in a few weeks from this cause, while others have lasted for years. To prevent, however, their destruction, in future, from this source, Mr. Allaire is now lining them with fire-brick, which, it is supposed, will combine their peculiar advantages with perfect safety.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Plan for a new Pump for Feeding Steam Engine Boilers, &c. By Charles Potts, Civil Engineer.

Having had occasion, some years ago, to construct a small steam engine, with a view to make a few experiments in dynamics, and being desirous to make all the parts of my engine in the most simple and easy manner, having the least quantity of work about them, I fell upon the following plans for introducing water into the boiler. As I believe there is something in this contrivance worthy the attention of the mechanician, and that it may, in many instances, be substituted with advantage for the ordinary pump, I am desirous of submitting it to the public, through the medium of your scientific journal. Before describing the plans, as exhibited in the drawing herewith presented, it may be well to premise, that the water intended to supply the boiler, is caused to flow therein by gravitation. Hence, it will be necessary, in all cases, that the water wherewith the boiler is to be fed, together with the apparatus herewith described for feeding, should be elevated above the level of the top water line of the boiler. Thus, in Fig. 3, Plate VII., C, D, represents the boiler of a steam engine, with the feeding apparatus, or pump, connected with it, and above it. In this figure, the feeding apparatus, or pump, in its general construction, very much resembles a common plug-cock. Fig. 4 exhibits another view of it; in both figures, the same letters of reference denote similar parts. A, B, is the plug, which is to be made *hollow*, as in Fig. 3, and to have its exterior surface turned true, and made to fit steam-tight into the shell, or casing, H, I. This casing is cast with two flanches upon it, one above, as *m*, *n*, and one below, as *s*, *t;* each flanch having an opening, *o*, *o*, through it. There is also an opening in the plug, as shown at *w*, Fig. 3.

During the operation of feeding, the plug, A, B, is caused to revolve around in its seat; this may be done by placing a pulley upon its axis, as shown at P, fig. 4, and strapping it from any convenient part of the engine. In order to show the operation of this machine more clearly, I have supposed a water tank, K, L, to be placed directly upon the upper flanch, with a pipe and ball cock from the *water pipes in the streets*, to supply it with cold water. The operation of this pump will be as follows: When the engine is put in motion, and, consequently, the plug, A, B, the opening, *w*, in the plug, will be brought round to the position shown in Fig. 3; in this position, the cold water from the tank above will *descend into the hollow or cavity* in the plug; but as the plug revolves, when the opening, *w*, has passed the opening in the upper flanch, the connection with the tank will be cut off; and when the opening, *w*, moves round, and comes over the opening in the lower flanch, the water from the plug will descend, and pass down the tube into the boiler, C, D. It will be obvious to the mechanician, that the quantity of water passed into the plug in one revolution, may be regulated in several ways, either by enlarging the opening into the plug, or by giving the plug a quicker, or slower, motion, at the time the openings are in juxtaposition.

To equalize the pressure above and below the water in the hollow of A, B, a small pipe, or channel, *x*, *y*, is made to the casing, H, I, whereby the steam passes up to the opening, *y*, in the casing; and when the opening, *w*, of the plug, is over the lower opening to the boiler, the small hole, *z*, will be in connection with the opening, *y*, so that the steam is then admitted into the top of the hollow of the plug, and the water in the plug will descend freely by the force of gravity. A similar opening may be contrived for the free admission of the water from the tank into the plug.

Having now described this pump, I shall make a few remarks in reference to what I conceive to be its advantages. And first: We have here an apparatus which will perform all the functions of a forcing pump, without valves. Secondly. The only resistance in the working of this pump, will arise from the friction of the exterior surface of the plug against the casing, as it revolves. And thirdly. It is a sure and certain regulator for the supply of water to the boiler. The first two items above mentioned are so obvious, that it were needless, perhaps, to comment upon them; the latter item, however, may not be quite so apparent. I will, therefore, show how the pump may serve as a *regulator*. The feed-pipe, *u v*, must be connected with the boiler at the top water line, as E, E. Now, if the pump supplies water faster than it is evaporated, and the top water line, E, E, rises so as to cover the opening of the pipe, the pipe would be filled with water, instead of steam, and, consequently, the water in the plug, A, B, could not descend. When, however, the top water line, E, E, of the boiler, descended below the opening of the pipe, *w*, *v*, the pump would again operate to supply the boiler. In this manner, it would work so that, if properly adjusted in the first instance, the water in the boiler would always be continued at its proper height. It will be seen that, every time the pump, or plug, A, B, discharges its contents into the boiler, the chamber of the plug becomes filled with steam, and will be allowed to pass off and condense, when the opening of the plug connects with the tank. This process, it must be evident, will be an advantage, rather than otherwise, as much of the caloric of the steam will thus be imparted to the water, previous to its passing into the boiler. I have preferred describing the above apparatus, as it is the most simple in its construction, and, therefore, more easily to be understood. The same end, however, may be effected by a very different arrangement, as will be seen by reference to Fig. 5. Here, A, B, represents a *hollow plunger*, being turned smooth and true on its exterior surface, and made to work up and down through two stuffing boxes, E and F, placed on the ends of the hollow cylinder, or box, C, D. The plunger has three openings, *o*, *p*, *q*, (or it may be one long slit from *o* to *q*,) for the purpose of allowing the water to flow into and out of the chamber, C, D, through the hollow plunger; the small tube, or channel, *r*, *s*, is to allow the steam to enter at the top of the chamber, C, D, in order that the water may flow freely out from the chamber into the feed-pipe, *v*. If we suppose the water tank, K, L, Fig. 3, to be placed on the flanch, *t*, *u*, Fig. 3, and the plunger, A, B, to be connected with the engine, so as to be caused to move up and down, as the plunger of the ordinary forcing pump, it will be perceived that, when the plunger is up, the hole, *o*, will be within the tank, and the hole, *q*, within the chamber, C, D; hence, water from the tank may flow in and fill the chamber, C, D; and when the plunger is down, as is represented in the figure, the hole, *q*, will be open to the boiler, and the water in the chamber will descend, through *p* and *q*, into it. The relative diameters of the plunger, and that of the chamber, C, D, may be varied to suit the motion which is given to the plunger.

Philadelphia, February, 1836.

P. S.—I am aware that, in the practical operation of the above described pumps, some difficulties will probably occur, but I am fully persuaded that they are not insurmountable. Thus, for instance, when the pump is designed to regulate the quantity of water to the boiler, as it would be necessary to have the connection of the feed-pipe with the boiler near the top water line, the water from the boiler would frequently rise in the tube, and run up to the pump before the body of water in the boiler had risen to cover the opening of the feed-pipe. This difficulty would be remedied by a small tube from the top of the boiler, Fig. 3, to the opening, *y*, in the casing of the pump.

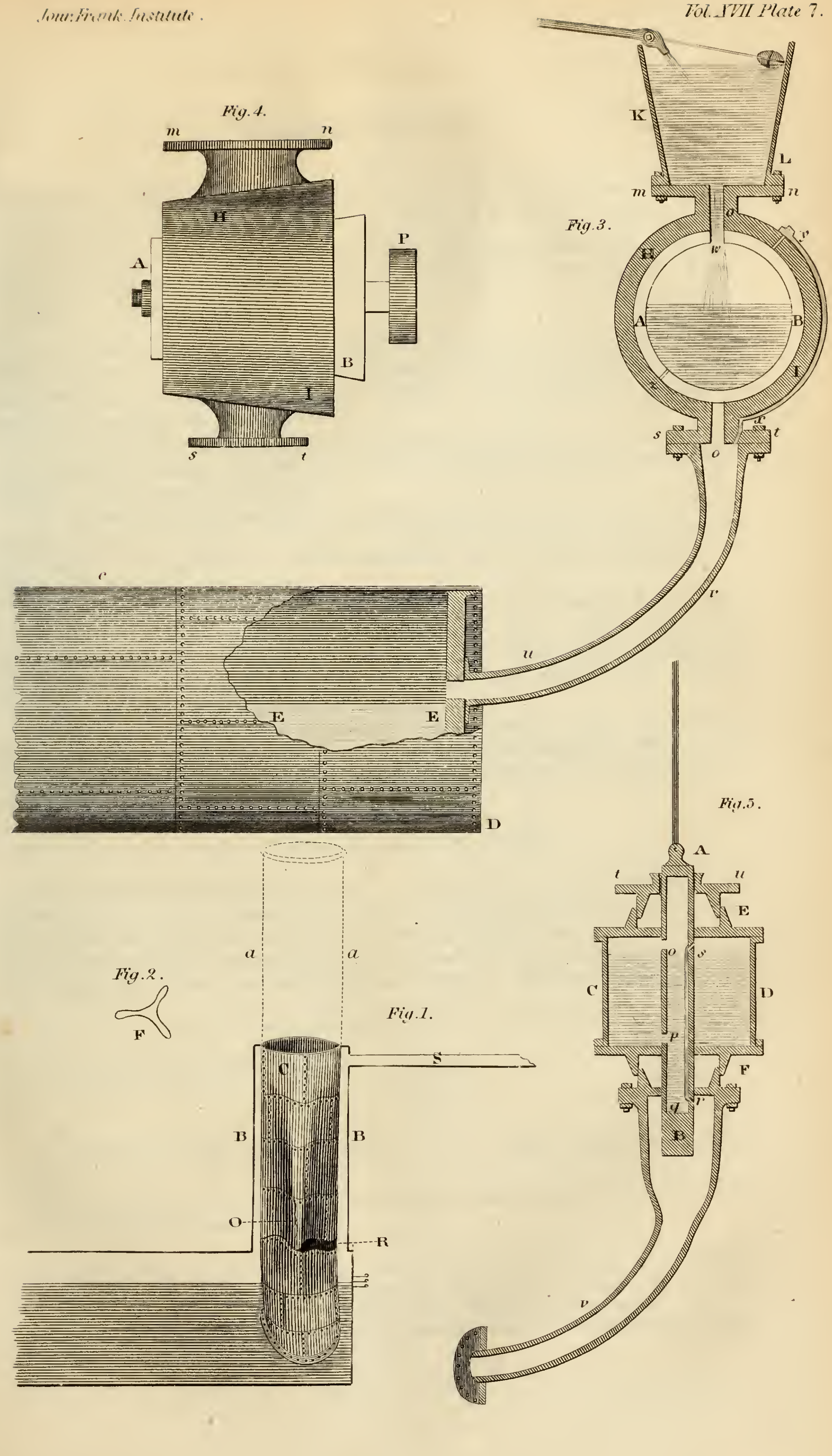


Fig. 4.

Fig. 3.

Fig. 5.

Fig. 2.

Fig. 1.

Physical Science.

Remarks on a Method, proposed by Doctor Thomson, for Determining the Proportions of Potassa and Soda in a Mixture of the two Alkalies, with the application of a similar investigation to a Different Method of Analysis.

By A. D. Bache, Professor of Natural Philosophy and Chemistry, University of Pennsylvania.

In a recent number* of the "Records of General Science," Doctor Thomson gives the following method of determining the proportions of potassa and soda in a mixture of the two alkalies. The method is accompanied by an example of its use.

"1. Convert the mixture of potash and soda into sulphates, render these sulphates anhydrous by ignition in a platinum crucible, and determine their weight. Let it amount to 29 grains.

"2. Dissolve the two sulphates in water, and throw down the sulphuric acid by chloride of barium. Wash the sulphate of barytes obtained, dry it and weigh it after ignition. Let the weight be 43.5 grains, indicating 15† grains of sulphuric acid.

"3. Separate any excess of barytes that may have been added to the liquid, by the cautious addition of dilute sulphuric acid. Filter, evaporate to dryness and ignite. The salt thus obtained will consist of the mixture of potash and soda converted into chloride of potassium and sodium. Weigh this salt. Let the weight be 24.5 grains."

"Now the atom of potash is 6, and that of soda 4: and it is obvious from paragraphs 1 and 2 that the mixture of potash and soda will weigh 14."

"Let the [number of] atoms of potash in the mixture be x, and those of soda y, it is plain that we have:

$$6\,x + 4\,y = 14, \text{ and } x = \frac{14-4\,y}{6}$$

"By comparing paragraphs 2 and 3, it is obvious, that the weight of the chlorine in the 24.5 grains of the mixed chloride obtained is 13.5 grains. For it must be equivalent to the 15 grains of sulphuric acid. In this mixed chloride the potash is converted into potassium, and consequently its atom only weighs 5, while the atom of sodium weighs 3. We have therefore

$$5\,x + 3\,y + 13.5 = 24.5 \text{ and, } x = \frac{11-3\,y}{5}$$

If we equate these two values of x, we have

$$\frac{14-4\,y}{6} = \frac{11-3\,y}{5}$$

By solving this equation we obtain $y = 2$. From which we deduce $x = 1$.

Thus it appears, that in the supposed mixture there were 6 grains of potash and 8 grains of soda."

---

* January, 1836. On the Method of Determining the Proportions of Potash and Soda, when the two Alkalies are mixed together. By Thomas Thomson, M. D., F. R. S. L. and E., Regius Professor of Chemistry in the University of Glasgow.

† The equivalents of baryta and sulphuric acid are here assumed as 76 and 40 respectively, referring them to the hydrogen unit.

Now it seems to me that the third step in the analysis, namely that contained in paragraph 3, is unnecessary, all the numbers required for the calculation having been obtained by the first and second steps.

By the first step we obtain the weight of the mixed sulphates; by the second the amount of sulphuric acid present, whence results the weight of the mixed alkalies. But incidentally we have obtained the quantity of oxygen present in the mixed alkalies; for the chloride of barium and the sulphates of potassa and soda have by their reaction formed sulphate of baryta, and chlorides of potassium and sodium. And the oxygen of the baryta in the sulphate of baryta, is equal to the oxygen of the two alkalies. Subtracting this from the weights of the alkalies we have, without the necessity for the third step proposed by Doctor Thomson, the weights of the metals. These weights furnish his second equation.

In the example referred to, we have found by comparing paragraphs 1 and 2, the weight of the mixed alkalies to be 14, whence calling x and y the unknown number of equivalents of the potash and soda respectively, resulted the equation

$$6\,x + 4\,y = 14, \text{ and thence } x = \frac{14-4\,y}{6}$$

From the second paragraph the weight of sulphate of baryta obtained is given 43.5 grains; whence using the same equivalents as Doctor Thomson has employed, the baryta is found to be 28.5 grains, of which 25.5 grains is barium and 3 grains oxygen. Deducting this oxygen, which belonged to the alkalies, from the weight of the mixed alkalies, we have 11 grains for the weight of the metals, and the second equation given by Doctor Thomson.

$$5\,x + 3\,y = 11, \text{ or } x = \frac{11-3\,y}{5}$$

It is plain that these remarks will be true if the nitrate of baryta should be substituted for the chloride of barium in obtaining the quantity of sulphuric acid present; for the quantity of oxygen in the baryta of the precipitated sulphate, will always be equal to that in any protoxide, or protoxides, saturating the same weight of acid.

The third step in the proposed analysis is therefore superfluous, unless used as a means of verification.

I propose now to obtain, as Doctor Thomson has done, in the sequel of his paper, general equations for calculating the weights of the alkalies from the analysis, omitting only a reference to the third step, which has been shown to be unnecessary. As algebraic notation is repulsive to some who may chose to refer to this method of analysis, I will endeavour finally, to prove the results by arithmetical processes, and to point out a simple method of calculation.

It seems to me more convenient to determine the absolute weights of the alkalies from a formula, rather than the number of equivalents.

Let v be the weight of the potassa in the mixture; z that of the soda. Let m be the weight of the mixed sulphates obtained as stated in paragraph (1), and n the weight of the sulphate of baryta obtained as in paragraph (2), then using 76* as the weight of the equivalent of baryta, and 116 as that of sulphate of baryta, the baryta in n, will be $\frac{19}{29}\,n$; and the oxygen contained in this baryta will be $\frac{2}{29}n$. But the oxygen in v grains of potassa is $\frac{v}{6}$, and in z grains of soda is $\frac{z}{4}$, and since the oxygen in the alkalies is equal to that in the baryta,

---

* I have used throughout the equivalent numbers given by Doctor Thomson in the seventh edition of his System of Chemistry, in order to preserve uniformity in the results.

$$\frac{v}{6}+\frac{z}{4}=\frac{2}{29}n, \text{ or } 58\,v+87\,z=24\,n.\ .\ .\ (\text{a.})$$

Again, the sulphuric acid in n grains of sulphate of baryta is $\frac{10}{29}n$, therefore the alkalies in the mixed sulphates (1) will be $m-\frac{10}{29}n$; that is

$$v+z=m-\frac{10}{29}n=\frac{29\,m-10\,n}{29},$$
$$\text{or } 58\,v+58\,z=58\,m-20\,n.\ .\ (\text{b},)$$

combining this equation with (a,) we find $z=\frac{44\,n-58\,m}{29}$, and,

$$v=\frac{87\,m-54\,n}{29}.$$

These formulæ lead to the following rules, the analysis having been made as described.

1st. For the weight of the soda. From 44 times the weight of the sulphate of baryta (2), take 58 times the weight of the mixed alkaline sulphates (1) and divide the difference by 29.

2d. For the weight of the potassa. From 87 times the weight of the mixed sulphates (1) take 54 times the weight of the sulphate of baryta (2), and divide the difference by 29.

In the example referred to by Doctor Thomson, $m=29$ and $n=43.5$, whence,

$$z=\frac{44\times43.5-58\times29}{29}=\frac{1914}{29}-58=8; \text{ and } v=87-81=6 \text{ grains.}$$

The following arithmetical process may be substituted for the algebraic one.

Having found the weight of the mixed alkaline sulphates (1) and the sulphuric acid which they contain (2) the weight of the mixed alkalies is known.

The oxygen which these mixed alkalies contain is known, being equal to that of the baryta in the precipitate of sulphate of baryta (2), or $\frac{2}{29}$ths of the weight of that sulphate.

Potassa contains $\frac{1}{6}$th ($\frac{2}{12}$ths), and soda $\frac{1}{4}$th ($\frac{3}{12}$ths), of its weight of oxygen. The oxygen of the mixed alkalies, found as just stated above, is equivalent to $\frac{2}{12}$ths of the weight of the potassa, and $\frac{3}{12}$ths of the weight of the soda; that is to $\frac{2}{12}$ths, or $\frac{1}{6}$th of the weight of the mixed alkalies, together with $\frac{1}{12}$th of the weight of the soda. Therefore taking from the weight of the oxygen in the mixed alkalies, $\frac{1}{6}$th of the weight of the alkalies themselves, the remainder will be $\frac{1}{12}$th of the weight of the soda.

From which is deduced a very simple rule.

Find, from the steps of the analysis, the united weights of the alkalies, and the weight of the oxygen which they contain. Take $\frac{1}{6}$th of the former weight from the latter, and multiply the difference thus found, by twelve. The result will be the weight of the soda. Subtract this from the weight of the mixed alkalies, the remainder will be the potassa.

To apply this to the example in which the weight of the mixed sulphates is 29, and of the sulphate of baryta, equivalent to their acid, is 43.5 grains.

43.5 grains of sulphate of baryta contain 15 of sulphuric acid. The united weights of the alkalies is therefore 14; $\frac{1}{6}$th of which is $2\frac{1}{3}$. The oxygen of the baryta, in 43.5 grains of the sulphate of baryta, is 3 grains. Taking $2\frac{1}{3}$ from three we have $\frac{2}{3}$ds, which multiplied by 12 gives 8 grains for the weight of the soda. This taken from 14 leaves 6 grains for the weight of the potassa in the mixture.

At the suggestion of my friend, Professor H. D. Rogers, I am induced to extend the foregoing method of calculation to the usual way of determining the quantities of the alkalies by their conversion into the chlorides of their metallic bases, avoiding the ordinary step which requires their separation by the use of chloride of platinum, by determining the chlorine in the mixture, by nitrate of silver.

(A) The alkalies are to be converted into muriates, if not already in that state, by the ordinary steps of mineral analysis. These being evaporated to dryness, ignited and weighed, will give the amount of chlorides of potassium and sodium which are present.

(B) Dissolve the mixed chlorides in water acidulated with nitric acid. Nitrate of silver will throw down the chlorine, and by treating the precipitated chloride of silver in the usual way, the quantity of chlorine is deduced from the weight of the fused chloride.

To calculate the weights of the alkalies; let v and z represent the weights of the potassa and soda respectively; c the weight of the mixed chlorides (A), and d that of the chloride of silver (B). Using 146 as the equivalent of chloride of silver, d grains of the chloride contain $\frac{18}{73}\,d$ grains of chlorine; the weight of the metals in the mixed chlorides (A) is therefore $c - \frac{18}{73}\,d$. But v grains of potassa contain $\frac{5}{6}\,v$ of potassium, and z grains of soda, $\frac{3}{4}\,z$ of sodium. Whence $\frac{5}{6}v + \frac{3}{4}z = c - \frac{18}{73}d$.

The oxygen contained in the mixed alkalies is $\frac{8}{36}$ths, or $\frac{2}{9}$ths of the chlorine in the chlorides of their metallic bases, or is $\frac{2}{9}$ths of $\frac{18}{73}\,d$, or $\frac{4}{73}\,d$. And as v grains of potassa contain $\frac{1}{6}\,v$ grains of oxygen, and z grains of soda, $\frac{1}{4}\,z$ grains of oxygen, we have a second equation containing v and z; $\frac{1}{6}v + \frac{1}{4}z = \frac{4}{73}d$, or $\frac{5}{6}v + \frac{5}{4}z = \frac{20}{73}d$. Combining this with the equation obtained above, $z = \frac{76}{73}d - 2c$, and $v = 3c - \frac{90}{73}d$.

Whence result the following simple rules.

To obtain the soda from the method of analysis stated above, from $\frac{76}{73}$*rds of the weight of chloride of silver* (B), *take twice the weight of the mixed chlorides* (A).

To obtain the potassa. From three times the weight of the mixed chlorides (A), *take* $\frac{90}{73}$*rds of the weight of the chloride of silver* (B).

To apply this to the example before discussed, suppose the weight of the mixed chlorides to be 24.5 grains, and of the chloride of silver 54.75 grains. From $\frac{76}{73}$rds of 54.75, or 57, take thrice 24.5, or 49, the remainder, 8, will be the grains of soda in the mixture.

From three times 24.5, or 73.5, take $\frac{90}{73}$rds of 54.75, or 67.5, the remainder, 6 grains, will be the potassa.

An equally simple method of calculation may be obtained without resort to algebra. By the second step of the analysis the chlorine in the mixed chlorides, of the metallic bases of the alkalies, is obtained, being $\frac{18}{73}$rds of the weight of the chloride; subtracting this from the weight of the mixed chlorides obtained by the first step, we have the weight of the metallic bases. Taking $\frac{2}{9}$ths of the weight of the chlorine, we have the oxygen requisite to form the alkalies. Potassa contains $\frac{1}{6}$th, and soda $\frac{1}{4}$th of the weight of oxygen ; $\frac{5}{6}$ths of the potassa and $\frac{5}{4}$ths of the soda, will be equal in weight to five times the oxygen, the weight of which has just been obtained. But potassa contains $\frac{5}{6}$ths of its weight of potassium, and soda $\frac{3}{4}$ths of its weight of sodium, and the united weights of these metals has also been obtained as above. Taking this latter sum from the former we find that *one half the weight of the soda is equal to five times the oxygen less the weight of the metals. One sixth of the weight of the potassa is equal to the weight of the oxygen, less one fourth the weight of the soda.*

Resuming the example before employed, in which the weight of the mixed chlorides is 24.5 grains, and of the chloride of silver 54.75 grains. The chlorine in 54.75 grains of chloride of silver is 13.5 grains. Subtracting this from 24.5 grains, we have 11 for the weight of the metallic bases of the alkalies. The oxygen equivalent to 13.5 grains of chlorine is 3 grains.

By the rule, 5×3 or 15, less 11, the weight of the metals, is half the weight of the soda; the soda is, therefore, 8 grains. The weight of oxygen, 3 grains, less one fourth of the soda, 2 grains, gives one sixth of the weight of the potassa. The potassa is therefore 6 grains.

It is readily seen that the general principle to which these results refer themselves, may be used with great effect in avoiding a difficult step in chemical analysis, by the substitution of a less direct, but more simple one, aided by easy calculations.

This problem is only a particular case of a general one, well deserving the attention of analytical chemists.

Essays on Meteorology. By James P. Espy, Mem. Am. Philos. Soc., &c.

No. II.

Theory of Hail.

On the principles established in the first essay, the spout, which is nothing but visible condensed vapour, may sometimes not reach entirely down to the surface of the earth, or sea, when the dew-point is too low for such an effect; in this case, it will appear as an inverted cone, reaching down from a cloud already formed.

It may here be observed, that a spout will always begin to be formed at a considerable elevation above the surface of the earth, because the vapour will always begin to condense there, from a law too well understood by meteorologists to need elucidation here. When, however, it begins to condense, it begins, also, by its diminished specific gravity, to rise, and then, if all circumstances are favourable, the cloud will increase as it ascends, and finally become of so great perpendicular depth, that, by its less specific gravity, the air below it, and contiguous to it, in consequence of diminished pressure, will so expand, and cool by expansion, as to condense the vapour in it; and then the air below this again, will, in its turn, experience a greater and greater expansion and refrigeration, and, consequently, condensation of vapour; and this process may go on so rapidly, that the visible cone may appear to descend to the surface of the sea, or earth, from the place where it first appears, in about one or two seconds.

The terms here employed must not be understood to mean that the vapour, or cloud, actually descends; it appears, to the spectator, to descend, but this is an optical deception, arising from new portions of invisible vapour constantly becoming condensed, while, all the time, the individual particles are in rapid motion upwards.

For the sake of illustrating the principle, without aiming at absolute numerical accuracy, let us suppose a dew-point ten degrees below the temperature of the air. Now, a diminished pressure of one pound to the square inch, will cause a fall of temperature of only six degrees, so that, in this case, the visible cone would not reach down to the surface of the earth, or sea, and the air would have to ascend a little more than 400 yards, before condensation would commence. I say *more* than 400, because, though the temperature sinks one degree for every hundred yards of elevation, the dew-point also sinks a little from the expansion of the air, and the same quantity of vapour occupying a larger space. But, if the dew-point in the above case had been only six degrees below the temperature of the air, then the spout, or visible cone of vapour, would have reached the earth.

Now, it is highly probable that a spout, in passing over the surface of the earth, would meet with slight variations in the dew-point, and, if so, it would rise as the dew-point fell, and fall as the dew-point rose; and thus the theoretical deductions correspond exactly with the facts.

Again, the direction of the two spouts, as also of the great storm with two veins of hail, mentioned in a former essay, was from the south-west to the north-east; and Pouillet says, that a large majority of these storms are known to move in this direction. I presume he means those which occur in France. Now, it is manifest that these storms, according to the theory, must move in the direction of the upper current into which they may ascend, for the top of the vortex will lean in that direction; and, as theory demonstrates, and observation agrees with that demonstration, that the uppermost current of air in the temperate zone moves constantly from the south of west, towards the north of east, this will satisfactorily account for the general tendency of these storms in that direction, all over the northern temperate zone, or, at least, above lat. 30°. For, from that latitude, down to the tropic of Cancer, the uppermost current of air moves nearly towards the north, and, within the tropic, it moves towards the north-west; and so the theory would lead us to presume that, in these regions, the storms will be found to move in these directions. Such is shown to be the fact by Mr. Redfield, as to all great storms which travel any considerable distance in the West Indies. And in the Philosophical Transactions, Lathrop's Abridgement, vol. 2, p. 107, it is said that hurricanes in the West Indies begin from the north-west, and terminate with a south-east wind.

It is quite reasonable to suppose that these spouts sometimes meet with a middle current, moving in a different direction from the uppermost, which will account for the exceptions to the general rule; for the spouts will, in such case, certainly lean, and, of course, move, in the direction of the middle current.

These three storms all occurred in the day, and two of them in the afternoon; and M. Pouillet says that many more occur in the day than in the night. Now, this is precisely what the theory would lead us to suppose, and the explanation of this fact affords me an opportunity of explaining the very commencement of those spouts which occur during the day. The sun, during the day, and especially in the afternoon, heats up the surface of the earth, and the air in contact with that surface, many degrees above the air, a few hundred feet above the earth. This heated air below, and cold air above, will form an unstable equilibrium, and a very slight agitation will cause to be formed upward vortices of the light air below, and downward vortices of the dense air above. Now, if the dew-point is not more than ten degrees below the temperature of the air in contact with the soil, the air of the upward vortex will not ascend much above one thousand yards, before the refrigeration, caused by expansion, will cause a beginning of condensation of vapour; and the moment this occurs, the velocity of upward motion is rapidly increased, from the expanding effect caused by the evolution of latent caloric, as before explained.

If the dew-point of the air at this elevation should be almost identical with its temperature, the cloud of the upward vortex will go on increasing in size and perpendicular height, until the air immediately below it, being pressed downwards with less and less weight as the cloud above increases in height and levity, will, by expanding more than the air which preceded it in the vortex, be cooled down to the point of deposition, before it reaches the elevation of one thousand yards. And if, in this case, the vortex should rise to a height sufficient to produce a diminution of pressure under it of one pound to the square inch, the cone of visible vapour, or cloud, will reach down to a point four hundred yards from the earth's surface. And, in general, the nearer the dew-point is to the temperature of the air, the lower will the visible spout descend; so that, if they had been assumed only six degrees apart, in the above case, the apex of the spout would have descended to the earth. And, if they had been assumed still nearer together, the spout would not only have descended to the earth, but it would have been of some considerable size there. Thus we find that this mode of calculation not only enables us to account for the more frequent appearance of these spouts in the day than in the night, but also to assign a reasonable, hypothetical cause, why these spouts, or storms, are sometimes broad, and sometimes narrow, and sometimes even do not reach down to the surface of the earth.

It is known, also, that spouts, and violent storms, are always preceded by calms. This fact, also, is easily explained by the theory. For, in the first place, it is known that a calm favours the production of a high dew-point, which is an essential ingredient in these storms; and, second, a vortex of great strength cannot be formed, unless it can rise nearly perpendicular to a great elevation, which never can happen where there is a strong wind. This will readily be admitted, when it is considered that the wind is always stronger at some distance above the surface of the earth, than at the surface itself; and, therefore, no vortex of any great height, in these circumstances, could be formed, for the upper part would be blown away from the lower.

I have frequently seen those large columnar clouds, which form in mid air during a warm summer's day, have their tops blown off by an upper current, when the lower air was almost still, and thus a vortex of great strength prevented from forming. That these clouds are actually formed by rising vortices, occasioned by the disturbance of the equilibrium of the air during the day, is rendered almost certain by the following facts. First. When the supply is cut off in the evening, by the air near the surface of the earth becoming cold, these clouds cease to form, and not unfrequently disappear, and a day with many clouds is followed by a cloudless night. On the supposition of upward vortices, this phenomenon is very simple and natural; but on any other supposition, it is utterly paradoxical, (especially when it is now known that depression of temperature is the only cause of the condensation of aqueous vapour,) how clouds can be formed under a meridian sun, which will be dissipated under the refrigerating influences of a nocturnal sky.

Second. I once saw, during a profound calm, those columnar clouds, in all parts of the heavens, appear to be coming slowly towards me, which I think can only be accounted for by supposing that they were all rising perpendicularly. These clouds, however, were gradually dissipated after they had increased to a considerable size, which proves beyond doubt that they were surrounded by air, at that elevation, whose dew-point was below the temperature of the air; and it may be added, that this is one of the cases where a spout cannot be formed, for the ascending air of the vortex will always, more or less, be mingled with the air through which it passes.

Again, nothing but an upward or a downward vortex will account for the well known fact, that, in these storms, the clouds are frequently seen to rush together with great rapidity, for some time, without overlapping each other, and crossing, which proves that they are on the same horizontal plane, and so demonstrates the existence of a vortex. I need hardly add, that other phenomena show that the motion, after meeting, is upwards, and not downwards.

Clouds have also frequently been seen to ascend, by spectators on mountains, and æronauts have found their temperature much higher than the surrounding air. Thus, it is demonstrated, beyond all doubt, that there is an upward current in these storms, whether the latent caloric given out by the condensation of the vapour, is the cause of that current, or not. And, as no fact in physics is better established than that precipitation will instantly take place, if saturated air is suddenly rarefied, we are sure, also, that this upward motion of saturated air will, by causing expansion, produce precipitation.

I had long been desirous to ascertain, by actual observation, how high these vortices carry the condensed vapour, or cloud, into the upper air, and a fine opportunity was afforded me, on the 31st of July, 1834. This morning, says my journal of that day, it begain to rain early, with the wind and lower clouds north-east, middle clouds south, and upper clouds west. Several showers occurred during the morning, and the wind gradually shifted round to the south-east. At 5 o'clock, P. M., a most violent shower, which lasted about fifteen minutes, came up from the north-west, and at the moment of the hardest rain, the lower wind being strong from the north-west, the lowest visible clouds in a south-east direction, were seen to move with great velocity in the opposite direction, towards the north-west.

As soon, however, as the shower passed off to the south-east, the lower clouds changed their course, and followed the shower towards the south-east, exposing to view, near the zenith, a most magnificent columnar cloud, with its summit and western side as white as snow, being exposed to a western sun, in a perfectly clear sky. This cloud seemed nearly stationary for some time in its upper snowy part, while the scattering clouds in its lower parts were seen to rush under it, towards the south-east, with great velocity. The principal cloud moved slowly and majestically towards the ESE.; the sun's rays gradually climbing up this mountain of snow, fourteen minutes after he set, his last beams ceased to illuminate its summit.

The altitude of this summit being taken by a sextant, was found to be nine and a half degrees. The line which bounded light and darkness, as it rose up the sides of this columnar cloud, was well defined, the western horizon being entirely free from clouds, so that I think I could not be mistaken one-quarter of a minute in the time when the sun's rays ceased to shine on the top of the cloud. Calculating from these data, I find the cloud reached to the amazing height of eleven miles, and that it travelled east-south-east, with a velocity of about forty-eight miles an hour.

A much more violent storm than this had occurred at Wilmington, (Del.) about twenty-eight miles south-west of Philadelphia, two days before this, as appears from Dr. Gibbon's Journal. He says it commenced raining with a thunder gust, at 5 o'clock in the morning, and poured down in torrents till half-past 7, when it ceased. In this short time, two and a half hours. $5\frac{1}{10}$ inches of water fell. This rain, he says, did not extend further than ten or fifteen miles from Wilmington, in any direction, except, perhaps, in an easterly course, in New Jersey.

On that evening, my journal says, "The upper clouds from the WSW. were tinged with pink, thirty-one minutes after seven o'clock, mean time. These clouds, being in the zenith, must have been the astonishing height of fourteen miles.

The angular velocity of one of these upper clouds was taken; it was found to rise from 25° to 32°, in two and a half minutes. Its absolute velocity, therefore, at this great height, was about two miles a minute. This great velocity is not at all inconsistent with the velocity with which storms are known generally to travel towards the north-east, in our latitude, even on supposition that this direction is given to the upward vortices of these storms, by this uppermost current, as explained before; for the inertia of the air in the vortices must be overcome, and, therefore, the velocity of the storm, at least the hinder part of it, cannot be so great as the velocity of this uppermost current.

There are many well authenticated accounts of showers of dust, and bloody, or, as I imagine, reddish rain, having fallen, and also of hail, with earthy or stony matter contained in the stones, and some with green leaves of forest trees; all these facts are mere corollaries from the theory. Prof. Zimmermann analyzed the sediment of some red rain which fell on the 3d of May, 1821, near Geissen, and found it to contain chrome, oxide of iron, silex, lime, carbon, and a trace of magnesia, but no nickel. On the 13th of August, 1824, in the city of Mendoza, in Buenos Ayres, dust fell from a black cloud, and at the same time, in another place, distant forty leagues, the same phenomenon occurred.

In Persia, near Mount Ararat, there fell, in the month of April, 1827, a shower of *seeds*, which, in some places, covered the earth to the depth of six inches. The sheep ate of it, and men made a tolerable bread of it. The French ambassador in Russia obtained some specimens of this grain, and sent them to Paris, where they were analyzed and examined by MM. Desfontaines and Thenard, and determined to be lichens of the genus Lecidea.

Now, as neither leaves of forest trees, nor seeds of lichens, can grow in the upper regions of the atmosphere, or be precipitated to the earth from any other planet, if these accounts are believed, and M. Pouillet doubts not the truth of them, then the existence of upward vortices, however these vortices may be formed, is established.—[Pouillet, p. 770.

The theory will also account for the water spout. Indeed, a spout at sea, and a spout on land, are identically the same thing, and many have been known to pass from water to land, exhibiting the same appearance in both situations. To show their identity, I will copy from Silliman's Journal, vol. xiv., p. 171, an account of a water spout seen off the coast of Florida, in the spring of 1826, by Benjamin Lincoln, M. D., of Boston.

"*April 5th.*—At 6 o'clock, A. M., an order was heard from the deck to get ready the gun on the weather quarter, and bring the muskets from the cabin. Recollecting what region we were in, my first thought was of an engagement with a piratical cruiser, but on going upon deck, it appeared that our enemy was a water-spout, bearing north, distant, according to the captain's estimation, about two miles, and coming down upon us before a whole-sail breeze. One musket was fired at it, but it had nearly effected a retreat before we got ready for action. I had just time to see it, and it disappeared.

"In a few minutes another appeared, which was said by the officers of the vessel to be much more distinct than any one they had ever seen before. I observed it attentively, but neglected to note the time, except at its commencement, and the end of the third spout, which appeared after the second and principal one had passed away. This omission renders it impossible to give the duration of its different stages with any good degree of exactness. The wind came from the land, blowing a whole-sail breeze. The thermometer stood at 72°. A black cloud, from which the spout proceeded, extended along from east to west, its lower edge very distinctly defined, even, parallel to the surface of the water, and elevated 25° or 30° above the horizon. No other cloud was visible in that quarter, but a haziness covered the whole heavens.

"A small, black, and perfectly defined cone, darted from the lower edge of the cloud, and pointed perpendicularly to the water, which, at the same moment, was seen flying upwards like spray on the rocks, It was distinctly noticed that the cloud grew blacker near the cone, appearing to be gathered in from all quarters, and condensed at this point.

"After the lapse of two or three minutes, the cone instantaneously extended itself to about twice its first length, and the water was thrown up higher. This continued a few minutes; then the apex of the cone suddenly leaving the truncated end jagged, from which little scirrhi were continually darting and disappearing, the water continuing as before. This appearance lasted two or three minutes, after which the cone gradually elongated itself, assumed the cylindrical shape, except near its junction with the rest of the cloud, and descended almost to the surface of the water. The time occupied by the descent was about two seconds. All these changes were instantaneous, except the descent, which was gradual. As the spout descended, the agitation of the water increased, boiling up on each side of the end of the spout, but not coming in contact with it. The spout was slightly curved, the convexity of the curve being towards the point whence the wind came. It appeared to be hollow, light in the middle, and black, like the cloud, at its sides. A waving, ascending motion, was distinctly seen in the middle, more distinctly near the water than near the cloud. This the sailors, with one accord, pronounced to be water going up the spout.

"This appearance lasted fifteen minutes, or more, the spout remaining entire and unchanged. Then it began to fade, and suddenly a section from its lower end disappeared, leaving the same scirrous jagged extremity before mentioned. One section after another disappeared in this way, the spout continuing to grow paler, the waving motion growing more distinct and slow, and the agitation of the water subsiding, till the whole disappeared. By this time, the wind had freshened considerably, and the cloud had spread over a great part of the heavens. In a few minutes after, another cone appeared, exactly like the first in all respects, and the same appearance was exhibited in the water under it. This continued a short time, and then disappeared.

"From the appearance of the first cone, till the disappearance of the last, was three-quarters of an hour.

"The wind continued to increase, and the cloud to gather blackness, and spread in every direction, till it enveloped the whole heavens. Next came a most vivid flash of lightning, with a most tremendous peal of thunder. It seemed as if heaven and earth had exploded at once, and in an instant all was calm, the sails hung loose, and not a breath of wind could be felt. Rain now began to fall, not in drops, but in torrents, and the wind came in gusts from every point of the compass. It continued to rain and blow in this way about fifteen minutes, after which it ceased, the wind in its former direction, the sky became clear, and we went on our way."

If any one will carefully examine the phenomena here described, and compare them with the two land-spouts described above, he will perceive their exact similarity in all the most important features,—the gathering in of the clouds at the upper end of the spout, where it lost itself in the cloud; the inverted cone of thick vapour descending; the commotion of the water, and the removal of the earth under the spout; and, above all, the rain that occurred after the termination of the spout.

It is worthy, also, of particular remark, that the rain lasted exactly the same length of time that the principal spout lasted, fifteen minutes, and probably it commenced thirty minutes after the spout, or fifteen minutes after its disappearance. And as this rain, and the spout, were undoubtedly parts of the same phenomenon, and if, according to the theory, the rain was condensed in the spout, and carried up by the spout, we are led to believe it must have been carried up a great distance, or it would not have taken thirty minutes to ascend and descend. It is true, that, in ascending, it would move upwards much slower than the vortex of air which carried it, for the drops would gradually increase in size in their upward motion, by the finer particles of condensed vapour constantly overtaking them in their course, and uniting with them, until, by their increasing size, and the diminishing force of the air, from its diminishing density, they would stop their upward motion, and be thrown off at the sides of the vortex, as explained before.

It is worthy of remark, also, that the suddenness with which "the cloud gathered blackness, and spread in every direction, till it enveloped the whole heavens," is easily and naturally accounted for by the outward motion of the vortex above, as explained in a preceding part of this essay. Even the direction in which the spout leaned, from the wind, could have been predicted from the theory.

In the Edinburgh Philosophical Journal, vols. v. and vi., are given descriptions and plates of water-spouts, which appear to me almost to demonstrate, of themselves, the theory here advanced. Several of these spouts were attended with rain, at the distance of about a quarter of a mile from the spout, and they all began to descend from the cloud in the form of an inverted cone, and gradually proceeded downwards to meet a smoke-like appearance, which rose from the surface of the water to meet it.

This cone was black at first, but, towards the end, it began to appear like a hollow canal; the sea water could, even while it was entirely black, be seen very distinctly flying up along the middle of it, as smoke does up a chimney, with great swiftness; and the wind, in all instances where mentioned, blew towards the spout below. These phenomena, with the exception of the hollow canal, have already been explained.

In the fourth volume of the Abridgment of the Transactions of the Royal Society of London, a description of many other spouts is given, attended with circumstances similar to those already described. One of these occurred in England, on the 3d of June, 1718. "It was stationary for a length of time not mentioned, and discharged an immense quantity of water, without thunder. It fell on a space about sixty feet over, and tore up the ground there seven feet deep to the rock, and made a deep gulf for about half a mile from that place, raising a stream below, so as to render it impassable." All this must have occurred in a few minutes, as, immediately on the appearance of the spout, some persons attempted to run home, but they found the brook already impassable.

By having deferred the publication of these essays so long, I am now enabled to refer to a highly interesting account of some water-spouts, seen by Lieut. H. W. Ogden, and communicated in the January number of Silliman's Journal.*

It was in May, 1820, in the edge of the gulf stream, the weather being very warm, and the atmosphere close and oppressive, when seven were seen in half an hour, varying in their distance from the ship, from two hundred yards to two miles. Lieut. Ogden says, "The atmosphere was filled with low, ashy coloured clouds, some of which were darker underneath than others, and from these the water-spouts were generally formed, each one from a separate cloud. In some instances, they were perfectly formed before we observed them, but, in others, we could see a small portion of the cloud, at first extend downwards, in the shape of an inverted cone, and then continue to descend, not very rapidly, until it reached the water. In other instances, however, we observed that this conical appearance of a portion of the cloud did not always result in the perfect formation of a water-spout. Several times we saw the cone project, continue for a short time stationary, then rise again slowly, and disappear in the clouds. This would, in some cases, occur two or three times to the same cloud; but, eventually, a larger and darker cloud would descend, and result in forming the visible spout, as above mentioned."

One spout passed within sixty yards of the ship, and, after having been visible more than twenty minutes, at the distance of about three hundred yards, its lower part became smaller, and then gradually rose, until entirely lost in the cloud, part of which still hung over them. Soon after this, several severe flashes of lightning struck near the ship, and the rain began to fall in large and very *cold* drops, perfectly *fresh*.

Bibliographical Notice.

The Naval Magazine, edited by the Rev. C. S. Stewart, M. A., aided by an Advisory Committee.

We hail with pleasure the appearance of the first number of a periodical bearing the above title. There can be no doubt but that a journal devoted to the objects and interests of naval science, and naval men, will produce the happiest results. We trust that a feeling of esprit de corps will connect itself with this publication, and that officers will be induced to exertion for the purpose of contributing to their *own* magazine, which they might not be disposed to make for one not purely professional. To this journal we must look for information as to those means best calculated to improve this important branch of our national defence. A naval school, ably and warmly urged, would, we feel satisfied, be brought nearer to its establishment, than by awaiting the slow progress of public opinion, now beginning to move decidedly in its favour. Independent criticism of existing defects; judicious observations on the merits or defects of the services of other nations; suggestions of improvements in naval science or practice; details of nautical operations, and of those matters of practical science which are connected with the profession, will afford, of themselves, a most abundant field of usefulness. Literature will strew some of her flowers over these more rugged paths, and sketches of scenes on shipboard, or on land abroad, lend interest even to the general reader.

---

* See also Naval Mag. No. 1, vol. I.

An earnest is given of co-operation with us in meteorology, a branch which naval men have so strong a necessity to study, and such excellent opportunities of studying to good purpose, by the publication of the meteorological circular of the Joint Committee of the American Philosophical Society and Franklin Institute, and of a meteorological table for January, 1836, by Dr. William Swift, of the New York naval station.

We look with interest for the appearance of the new work, announced in the pages of the journal, on navigation, by passed midshipman Maury, of the United States' navy. B.

Franklin Institute.

Monthly Conversation Meeting.

The sixth monthly conversation meeting of the Institute, for the season, was held at their Hall, February 25th, 1836.

Mr. Franklin Peale exhibited a working model of a press, for cutting out coin, intended to be worked at the United States' Mint, by steam power. Specimens of a medal struck in commemoration of the first steam coinage, were presented.

Messrs. B. Slater & Co. submitted for examination, a patent stop motion for roving frames, invented by T. and J. O. Lewis, of Wilkinsonville, Mass. The stop was simple and effective.

A model of a canal boat, by Mr. A. Mason, of Pittsburgh, was upon the table.

Col. B. Chew, Jr. made some general remarks in regard to the working of the salt springs of Pennsylvania, inviting inquiry into the source of the brine, with a view to what he considered might be a more effective mode of obtaining salt.

Mr. John C. Cresson presented a specimen of Alabama cotton, in the pod.

Prof. A. D. Bache showed the action of a safety alarm for steam boilers, described by him in the Journal of the Institute in 1832, and recently made the subject of experiment by the Committee on the Explosions of Steam Boilers.

REPORT OF THE COMMITTEE OF PREMIUMS AND EXHIBITIONS.

Ninth Exhibition of Domestic Manufactures, held by the Franklin Institute, of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

To the Managers of the Franklin Institute.

The Committee on Premiums and Exhibitions report—

That the Ninth Exhibition of the Institute was held agreeably to the announcement of the Board, on the 7th, 8th, 9th and 10th of October.

In presenting the result of their labours, the committee have great pleasure in congratulating the Institution and the community upon the rapid advancement to perfection in many branches of industry, of which they have received evidence from the display now closed. To those whose intimacy with the progress of these exhibitions of the Institute, enables them to recur to the state of the arts in this country, as evinced at its early exhibitions, the decided superiority of the fabrics of the present day, is peculiarly striking, and it must be a source of no small gratification to them to reflect how much the country is indebted to the exertions of the Institute, in producing this improvement, by exciting emulation among the producers, and by introducing their fabrics to the notice of the consumers.

In furtherance of the objects which this Institute have had in view, results of a similar character have been had in our sister city, New York, by the exertion of similar institutions, and the committee take this opportunity to express their satisfaction at the good feeling which exists between them and this society. Delegations from the American Institute, whose fair was held during the week subsequent to ours, and from the Mechanics' Institute, whose fair had been previously held, visited the Exhibition of this Institute. The good feeling thus expressed was reciprocated on our part by sending a delegation to the fair of the American Institute, and it is to be regretted that circumstances prevented our sending one to that of the Mechanics' Institute also.

If at the exhibition of this institution just closed, the number of specimens presented was not so great as on some former occasions, it must be attributed to a cause at which all will rejoice. The uncommon prosperity of the manufacturing community has prevented many who usually contribute their share to enhance the splendour of our shows from presenting samples of their work, in very many branches of industry, the manufacturers have found themselves during the past summer unable to keep pace with the growing demand.

Of the Premiums offered by the Institute in the printed list, a large number have been claimed by competitors which the committee, after a fair investigation of their respective merits, by disinterested judges, appointed for that purpose, have awarded as follows.

Cotton Goods.

Premium No. 75. For the best samples of checked and corded muslin, is awarded to Joseph Bancroft, of Wilmington, Del. for specimen No. 222, decidedly the best of the kind that had come under the notice of the judges.

Premium No. 82. For the best samples of rich chintz prints, for ladies' dresses, is awarded to Philip Allen, of Providence, R. I. for specimen No. 174, of which the judges remark that the style is excellent, the colours brilliant, and the printing accurate.

Premium No. 85. For the best samples of cotton handkerchiefs, in imitation of Madras, to measure square, of cotton yarn not under No. 40, is awarded to William H. Cheetham, of Philadelphia county, for specimen No. 38, superior, in the opinion of the judges, to any before exhibited.

Premium No. 86. For the best samples of 4-4 fancy striped or checked ginghams, in imitation of Scotch; of yarn No. 40 or upwards, is awarded to William H. Cheetham, of Philadelphia county, for specimens No. 35, 36 and 37, being superior, in fineness of texture, colouring, and general finish, to any that have before come under the notice of the judges.

Premium No. 90. For the best samples of pantaloon stuff, 3-4 to 7-8 wide, all cotton, or cotton and wool, is awarded to William H. Cheetham, of Philadelphia county, for specimens No. 33 and 34, which closely resemble the foreign article, and were much sought after during the past summer.

Woollen Goods.

A certificate of honourable mention is awarded to W. & D. D. Farnum, of Waterford, Mass. for specimen No. 140, a small piece of sattinet, of which the judges remark that it is not surpassed by any similar article which has ever come under their inspection. Had the quantity of this article been sufficient, it would have been entitled to the premium.

A certificate of honourable mention is awarded to the Pequonnock Company, Bridgeport, Mass. for specimens No. 156, three printed table covers, which the judges pronounced to be highly creditable specimens of a new branch of manufactures.

Carpets.

Premium No. 106. For the best sample of Venetian carpeting 27 or 36 inches wide, is awarded to Isaac Macauley, of Philadelphia, for specimen No. 342, extremely well manufactured, chain very fine, colours good.

Premium No. 107. For the best specimen of Brussels carpeting, 27 or 36 inches wide, is awarded to Isaac Macauley, of Philadelphia, for No. 487, one piece of well manufactured goods, showing considerable improvement since the last exhibition.

A certificate of honourable mention is awarded to Miss Sarah Ann Fling, of Philadelphia, for specimen No. 593, a hearth rug, exceedingly well manufactured, and handsome design.

Silks and Laces.

A certificate of honourable mention is awarded to Joseph Ripka, of Philadelphia, for specimen No. 346, a small parcel of sewing silk of excellent quality, but not in sufficient quantity to be entitled to the premium.

A certificate of honourable mention is awarded to Boswell and Crowley, of Philadelphia, for specimen No. 312, a lot of pongee handkerchiefs dyed by them upon which much commendation was bestowed for the beauty and regularity of the colour.

Straw Bonnets.

The Silver Medal of the Institute is awarded to Miss E. White, of Philadelphia, for specimens No. 122, several straw bonnets, which were much admired for neatness of style and excellence of quality.

Surgical Instruments.

The display of Surgical Instruments was very extensive, and afforded gratifying evidence of the high state of perfection attained in this branch of the arts. Two sets of amputating instruments, No. 256, made by Wiegand and Snowden, and No. 298, made by George P. Schively and Co. both of Philadelphia, were selected by the judges as most worthy of premium No. 52; but upon a minute comparison, their merits appeared so nearly balanced that it was impossible to determine which was best. Under these circumstances the committee have awarded to George P. Schively and Co. a certificate of honourable mention; Mr. Wiegand being a member of the Board, cannot, under the regulations of the exhibitions, receive any award.

A certificate of honourable mention is awarded to John Rorer and Son, for specimen No. 488, a lithontriptic instrument, admired for its high finish.

Cutlery.

Premium No. 60. For the best saddlers' tools, is awarded to J. English and H. & F. A. Huber, of Philadelphia, for specimen No. 12, an assortment of saddlers' tools, which were pronounced by the judges superior to those usually imported.

A certificate of honourable mention is awarded to N. P. Ames, of Springfield, Mass. for specimens No. 407, five swords of excellent quality and finish.

A certificate of honourable mention is awarded to F. W. Widmann, of Philadelphia, for his specimens of sword mountings, which are highly creditable to the maker for the chasteness of the design and beautiful finish of the work.

A certificate of honourable mention is awarded to Rochus Heinisch, of New York, for specimens No. 249, several pair of compound lever shears, the form of which was correct, and the polish very perfect.

Hardware.

Premium No. 41. For the best brass wire of assorted sizes, from No. 70 to 25, is awarded to Holmes, Hotchkiss, Brown and Elton, of Waterbury, Conn. for specimen No. 281.

Premium No. 55. To the maker of the best stock or standing vice, equal to those known by the name of tower vices; is awarded to A. Lamont, of Pittsburg, Pa. for specimens No. 166, five bright vices, which will not suffer by comparison with the celebrated vice adopted as a standard.

Premium No. 57. For the best wood screws of iron or brass, assorted sizes, from one-fourth of an inch to 3 inches, is awarded to J. G. Pearson and Brother, New York, for specimens No. 267, an assortment of wood screws, fully equal in cutting and finish to those usually imported from England.

Premium No. 58. For the best screw augurs, assorted sizes, from two to eight quarters; is awarded to David Basset, of Derby, Conn. for specimens No. 378, which the judges believed would give entire satifsaction to the mechanic, and exclude foreign competition.

Premium No. 70. For the best portable scales, to weigh from 3 lb. to 12 cwt. is awarded to E. and T. Fairbanks and Co. of St. Johnsbury, Vt. for specimen No. 157, a portable platform compound lever scale, which long experience has proved to be extremely accurate.

A certificate of honourable mention is awarded to Joseph Nock, of Philadelphia, for his fire-proof chest lock, ingeniously devised to sound an alarm.

A certificate of honourable mention is awarded to Scovill and Co. of Waterbury, Conn. for their specimens of brass hinges, which are rapidly driving the foreign article out of the market.

A certificate of honourable mention is awarded to Webster and Co. of Albany, New York, for their specimens of enamelled hollow ware, which they have succeeded in bringing to great perfection.

A certificate of honourable mention is awarded to D. Simmons and Co. of Albany, New York, for the specimens of edge tools, of their manufacture, which were judged equal in quality and general finish to any made in this country, and much superior to the imported article.

A certificate of honourable mention is awarded to Rockwell and Hinsdale, of Winchester, Conn. for their scythes and straw knives, which were highly commended by the judges.

A certificate of honourable mention is awarded to Thomas and Benjamin Rowland, of Cheltenham, Philadelphia county, for specimens of shovels and spades, and of long saws, which justly bear a very high reputation.

A certificate of honourable mention is awarded to Israel White, of Philadelphia, for an assortment of carpenters' planes, finished in a very workmanlike manner.

A certificate of honourable mention is awarded to Edward W. Bushnell, of Philadelphia, for his specimens of gauges and squares; tools much in demand, and possessing all the requisite qualities to insure good work.

Silver Ware.

A certificate of honourable mention is awarded to R. and W. Wilson, of Philadelphia, for the chasteness and beauty of their specimens of silver ware, which were much admired.

There was also an extensive assortment of this beautiful ware, from the manufactory of Fletcher and Bennett, which contributed much to enhance the splendour of the exhibition, but as Mr. Fletcher is an officer of the Institute, he is precluded from competition.

Saddlery.

A certificate of honourable mention is awarded to James E. Brown, of Philadelphia, for specimen No. 67, a set of coach harness, very neat and creditable to the maker.

A certificate of honourable mention is awarded to A. M. Wagner, of Philadelphia, for specimen No. 120, a gentleman's saddle, esteemed by the judges a very superior article.

A certificate of honourable mention is awarded to T. Benninghove, of Philadelphia, for specimen No. 381, a fancy bridle and martingale, a very difficult and well executed piece of work.

Stoves and Grates.

A certificate of honourable mention is awarded to Joseph Snyder, of Philadelphia, for specimen No. 414, a parlour grate of very neat pattern, and designed to economize the heat by means of a circulating air chamber.

A certificate of honourable mention is awarded to R. Pierpont, of Taunton, Mass. for specimen No. 72, a doric fire-place, favourably spoken of by those who have given them a trial.

Philosophical Apparatus.

The silver medal of the Institute is awarded to William J. Mullin, of New York, for his specimens of watch dials, a very beautiful article.

A certificate of honourable mention is awarded to Alva Mason, of Philadelphia, for his specimens of philosophical apparatus.

A certificate of honourable mention is awarded to Isaac Schnaitman, for his improved double lens spectacles, highly approved by the judges.

A certificate of honourable mention is awarded to Thomas Ewbank, of New York, for his syphons, which will be found very useful in transferring liquids. The judges suggest that these should be referred to the Committee on Science and the Arts.

Guns.

Premium No. 7, to the maker of the best rifle gun, with percussion lock, and double or hair trigger, to carry balls from 60 to 100 to the pound, is awarded to Allen & Ball, of Springfield, Mass. for specimen No. 212, an examination of which, by competent judges, could not fail to procure for it high commendation. Several other specimens were presented by Messrs. Allen and Ball, which bore testimony that they came from a master hand.

Models and Machinery.

A certificate of honourable mention is awarded to S. Gerhard, of Camden, N. J. for No. 566, a machine to facilitate the manufacture of shoes, which evinced much ingenuity.

Lamps.

Premium No. 30, to the maker of the best and most extensive variety of mantel, astral, or hanging lamps, is awarded to Christian Cornelius and Son, for the rich and beautiful exhibition of these articles, from their workshops, equal in beauty and excellence to any of foreign manufacture.

This country is much indebted to Messrs. Cornelius, for the advanced state which this useful art has attained.

Musical Instruments.

After an elaborate and careful comparison, the judges report, that they would be guilty of great injustice to more than one maker, were they to recommend the award of a premium to any specimen exhibited; so near did they approach each other in excellence, a great improvement being manifested in all the instruments since last exhibition. Certificates of honourable mention are therefore awarded to Messrs. Conrad Meyers, C. F. L. Albrecht, E. N. Scherr, Groves and Wohlen, William Feuring, Loud and Co. and Thomas Loud.

In one of the pianos exhibited by Loud & Co., a new arrangement has been introduced, under the name of compensating tubes, intended to sustain the instrument in tone through different changes of temperature. This is considered, by the judges, one of the greatest improvements that has been effected in this instrument for a long time. But, as it is an invention coming more directly within the province of the Committee on Science and the Arts, it is referred to them for the purpose of receiving, if original, the Scott's legacy premium.

Paints and Colours.

The silver medal of the Institute is awarded to George C. Osborne, of

Philadelphia, for specimen No. 13, a case of water and oil colours in cakes. By the latter production, Mr. Osborne has supplied a want long felt by artists. It is deemed by the judges a very important invention, being much more convenient for landscape and miniature painting, than any other mode of preparation.

Several gallons of copal varnish were offered in competition for premium No. 117; this will be subjected to the test of twelve months' use, according to the terms of the premium, and the results made known in a future report.

China and Glass.

Premium No. 23, to the manufacturer of the best specimens of porcelain, is awarded to Judge Hemphill, of Philadelphia, for the assortment of this beautiful ware from his manufactory, most of which exhibited a decided improvement since the last exhibition, and will compare advantageously with the French china.

Certificates of honourable mention are awarded to the New England Glass Company, and to the Boston and Sandwich Glass Company, for their specimens of glass ware, considered by the judges highly creditable to the manufacturers.

A certificate of honourable mention is awarded to George Drummer, of Jersey city, for specimens of astral lamp shades, some of which were of extraordinary size.

A novel and interesting exhibition was furnished from the pottery of Mr. Abraham Miller, of Philadelphia, consisting of a variety of specimens of black and red earthenware, in the various stages of its manufacture, from the crude material to the finished ware.

Marble Work.

Premium No. 128, for the best urn in marble, for a monument, is awarded to James Stewart, a lad in the employ of Mr. John Struthers, for specimen No. 248.

A considerable variety of marble mantels was presented at this exhibition, an examination of which affords conclusive evidence that home-bred artists can produce specimens of ornamental carving, equal in richness and elegance to any that can be obtained in foreign countries. The merits of the different mantels exhibited was so nearly balanced, that a premium could not justly be awarded to any one. The committee have, therefore, awarded certificates of honourable mention to Messrs. Tennant & Highlands, for specimen, No. 214, and to Vanderbill, Bacon & Wilde, for specimen, No. 347.

Two carved mantels, No. 437, and a carved tablet, No. 476, intended for a mural monument, were exhibited by John Struthers. These were both excellent specimens of work, but as Mr. Struthers is a member of the Board, he is precluded from receiving any award.

A certificate of honourable mention is awarded to David G. Wilson, a lad in the employ of Mr. Henry Sailor, for specimen No. 96, a piece of carving, which affords promise of future eminence in his occupation.

A certificate of honourable mention is awarded to John Batten, for specimen No. 250, a bust of William Strickland; and No. 261, a head of Ariadne, in relief; the execution of which confers much credit upon the sculptor.

Cabinet Ware.

A certificate of honourable mention is awarded to James Kite, of Philadelphia, for specimen No. 145, a writing desk, made of a variety of American woods, introduced with skill and good taste.

There were several other specimens of cabinet ware exhibited, which, both in style and workmanship, were creditable to the makers, and fully sustained the character which Philadelphia has borne of preeminence in this branch of manufactures.

Leather, and Manufactures of Leather.

Premium No. 113, for the best specimens of white sheep skins, suitable for apothecaries' use, finished equal to that now imported from France, is awarded to Doyle & M'Neely, of Philadelphia, for specimen No. 306, two dozen skins, well got up.

A certificate of honourable mention is awarded to Doyle & M'Neely, of Philadelphia, for specimen No. 305, two bundles of morocco boot leather, of very superior quality.

A certificate of honourable mention is awarded to J. P. Alberger, of Phildelphia, for specimen No. 144, a russet trunk, well finished, and substantial.

Hats.

A certificate of honourable mention is awarded to C. F. Raymond, of Philadelphia, for his specimen of four dollar hats, the quality of which was very superior, and would have entitled him to the premium, had he exhibited the requisite quantity.

Certificates of honourable mention are awarded to Thomas Elmes & Co. and to Wilson & Laing, for their specimens of silk hats, pronounced, by the judges, the best exhibited.

A certificate of honourable mention is awarded to Brown & Siddons, for the improvement manifested in the hair seal caps manufactured by them.

A certificate of honourable mention is awarded to J. Chandler Smith, for the superior six dollar and nine dollar hats exhibited by him.

A certificate of honourable mention is awarded to E. Kimber, Jr., for his specimens of fur bonnets.

Books and Stationary.

Premium No. 13, to the maker of the best white vellum quarto post papaper, made from the best No. 1 domestic rags, weighing not less than eight pounds per ream, is awarded to the Brandywine Manufacturing Company, for specimen No. 189.

The other articles of stationary were numerous, and some of them very creditable to the trade, but there was nothing among them requiring a special award.

Fancy Articles.

The silver medal of the Institute is awarded to John Yard, Jr., of Philadelphia, for his beautiful display of pearl work, in the manufacture of which he has attained great perfection.

The silver medal of the Institute is awarded to the Pennsylvania Institution for the Instruction of the Blind, for the general assortment of their manufactures, an inspection of which affords pleasing evidence that the individuals who compose this unfortunate class are capable of becoming useful members of society.

A certificate of honorary mention is awarded to Reuben S. Gilbert, of

Philadelphia, for specimens of engraving on wood, evincing very great improvement in this art.

A certificate of honourable mention is awarded to the pupils of the northwestern public school, for specimens of lace work, of superior quality.

Paper Hangings.

A certificate of honourable mention is awarded to Charles Longstreth, of Philadelphia, for his varied and beautiful display of paper hangings, which do much credit to his skill and good taste.

The brevity required in this report necessarily excludes a great variety of interesting articles, which deserve commendation; but as the committee intend availing themselves, as far as practicable, of the reports of the judges, for future publication, the merits of these will be more fully and satisfactorily discussed.

The committee cannot close their labours without expressing their obligations to the gentlemen who composed the committees of arrangement, and of judges, for their exertions in forwarding the views of the Institute, and promoting the great cause in which it is engaged.

All which is respectfully submitted.

Samuel V. Merrick,
Joshua G. Harker,
William H. Keating,
Frederick Fraley,
Isaac B. Garrigues,
Alexander McClurg,
Alexander Ferguson,
John C. Cresson,
Committee on Premiums and Exhibitions.

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1835.

With Remarks and Exemplifications by the Editor.

1. For an improvement in the *Double Speeder;* William Field, North Providence, Providence county, Rhode Island, October 6.

This improvement "consists in a plan of compressing the roving on the spool so hard, or compact, that the same quantity may be put on a spool of only one-fifth of the common size. A machine with this improvement will occupy only one-half of the room, will require much less power, and will run at least one-third faster than common speeders." The usual plans for drawing, twisting, and winding, the roving, are followed; but the spools are run faster than the flyers, to take up the roving, instead of permitting them to fall back, in the common manner. The flyers are supported wholly above and independent of the spindles, are about one-half the usual length and diameter, and have a hoop at their lower ends to prevent their expanding.

The condensation of the roving is effected by the pressure of a thin, circular, plate against it, as it is wound on the spool; the plate being about the same diameter as the spool.

The claims are to "the plan of compressing roving on spools by circular plates, having a rotary motion, acquired by their pressure on the spools, the edges of which act on the roving as it is received from the flyers, and thereby condense it, so that a much greater quantity can be deposited on spools of the same size. The sliding rail in the rear of the spools, on which the circular plates are placed, and the connection between the increasing size of the spools, and the traverse motion of the belt guide, so that the spools may cause the variation of speed which their constantly increasing size requires. The application of a heart motion for traversing the spools, so formed as to cause them to rise with greater velocity than they fall, so that a less quantity of roving may be deposited on the spools when rising than when falling."

---

2. For an improvement in *Lamps;* Samuel Rust, city of New York, October 6.

The improvement here described is to be applied to lamps with flat wicks, and consists of a notched roller for raising the wick, the roller crossing it near its upper end, and being turned by the finger and thumb. We are much mistaken if such a contrivance has not been previously in use, for the same purpose.

---

3. For *Glazing or Preparing Pelisse Wadding;* Stukely Turner, Cranston, Providence county, Rhode Island. First patented July 25th, 1833; patent surrendered, and reissued upon an amended specification, October 6.

At p. 37, vol. xiii., we gave a sufficiently full account of this apparatus, and remarked that it did not contain any claim; the surrender and reissue thereof is intended to cure this defect, the following claims being now made.

"Of the above described apparatus, I claim as my invention the improvement of taking the cotton from the carding machines, and carrying it on an apron, or aprons, to the first glazing roller. I also claim the placing at the other end of the machine, a second glazing roller, with two upper rollers, all constructed like the first, to glaze the other side of the sheet of cotton. I also claim the placing two pressing rollers, instead of one, over each glazing roller. I also claim the carrying the cotton to the second glazing roller by an apron, after it has passed over the first glazing roller, and of carrying the cotton after it has passed over both glazing rollers, and been glazed on both sides, on an apron, until it is sufficiently dried, and the rolling it on a beam, which is revolved by the friction of the last mentioned apron."

---

4. For a *Planing Machine;* Reid R. Throckmorton, city of New York, October 6.

This machine differs from those which have preceded it to such an extent as, in our opinion, to merit the character of novelty; that of utility it must acquire, if at all, by its actual performance. The general arrangement of the apparatus only, is shown by the specification and drawing; but, if constructed from these, most of the details would have to be invented by the builder, as the information given is very defective in this respect. The plane is to be about three feet long, and its face is to be a segment of a circle, of about eight feet in diameter, and there are to be seven, or more, plane irons, or cutters, extending from it, of such width as may be necessary.

To the upper part of the plane, a rod, or shackle bar, is attached, the other end of which is moved by a crank, thus causing the plane to traverse, or rather to vibrate, backward and forward, with a rocking, or curved, motion. How the cutters are to be kept upon the plank, and caused to cut to a proper depth, does not appear, as, in the drawing, they are represented as standing out like knives, far below the face of the plane. Tongueing and grooving is to be effected in a similar way, by cutters operating laterally, and moved by a crank. The claim is to "the peculiar construction of the plane, and the nature of its motion, being vibratory and rectilineal," &c. There must be more in this machine than is described in the specification, or than meets the eye in the drawing, or it will be found of little value.

---

5. For *Fire-places and Furnaces;* Ebenezer S. Greely, Dover, Penobscot county, Maine, October 6.

The patentee calls this an air fireplace, and says that the improvement is founded on its construction, and conveying heat from one room to another, without any risk of fire, &c. The whole affair consists in having the top, hearth, back, and jambs, of the fireplace, hollow, conducting air into them from without, and distributing it, when heated, by means of pipes. There is not any claim made to this mode of constructing fireplaces, and we presume that there are but very few of our readers who are not aware that, so far as our description goes, there is nothing to claim; the same may be said of the whole, as specified.

---

6. For a machine for *Thrashing and Cleaning Clover, or Rice;* Moses Davenport, Phillips, Somerset county, Maine, October 6.

The machine here described consists of a long trough, containing the feeding, rubbing, and other apparatus. It is too complex for verbal description, but its characteristic feature appears to be, the passing of the seed between rubbing boards, covered with perforated metal, or otherwise made rough, the lower board being stationary, and the upper one, as it vibrates, bearing on the seed in one direction only, it being raised in the return stroke.

---

7. For an improvement in the mode of *Rearing Silk Worms;* Gamaliel Gay, Poughkeepsie, Dutchess county, New York, October 6. (See specification.)

---

8. For an improvement in the *Saw Mill;* Uri Emmons, city of New York, October 6.

The proposed improvement consists in hanging the saw, without employing a saw frame, and in using springs to counteract the weight of the saw, the pitman, and other appendages. The spring it is proposed to make of wood, and to fix it like that of a pole lathe. The saw is to have a jointed lever extended back from it, both at top and at bottom; these, when the saw is down, will be at right angles to it, and as they rise in a segment of a circle, will draw the saw back, so as to allow the feeding of the log. Both above and below the log, the saw is to pass between cheeks, or guide pieces, to keep it steady.

The claim is "to the construction and application of the first described spring to the common saw gate; and also the construction of the second described apparatus in every respect, as they may differ from any thing else before used or known," &c.

The law requires that the patentee should distinguish his invention from all other things before used, or known; but, in the case before us, this task is put upon the public, a task from which they ought to be relieved, as it would impose upon them the ungrateful necessity of informing the patentee that saw gates have been sustained by reacting springs; that saws have been hung without frames, by vibrating levers; that guides, such as he has described, have often been used, and that they, therefore, are unable to discover any thing novel in his invention.

---

9. For a *Chaffing Thrashing Machine;* Russel Bradley, Williston, Chittenden county, Vermont, October 6.

We cannot afford more lines to this apparatus than there are pages in the specification of it. The unthrashed straw is to be laid lengthwise in a feeding trough, where it comes into contact with a revolving cylinder, carrying circular saws, at short distances apart, serving to cut the whole into chaff; it then descends to a thrashing cylinder, and thence passes through a winnowing machine of the ordinary construction. The claim is to the application of the circular saws.

---

10. For a *Spring Saddle;* Joel Woodward, Marshalton, Chester county, Pennsylvania, October 6.

The spring part of this saddle is confessedly similar to such as are already in use, consisting of a flat side, having a spring wound spirally round it; the claim to *improvement* is merely in the mode of putting the parts together by screws, so that they may be easily separated. The kind of spring used was made the subject of a patent about a year or two ago; the present patentee cannot, therefore, adopt it as his own, merely because he has put it together in what he deems a more convenient way. If the patent alluded to was for a plan previously known, and belonging to the public, he may certainly sustain what is new in his own mode.

---

11. For a machine for *Shaving Staves, Heading, and Shingles;* John Everhart, Jacob Pearson, John Morford, and Nathan Everhart, Warren county, Ohio, October 6.

The specification of this instrument is laboured, but obscure; the drawing is very well executed, but does not exhibit the parts in detail sufficiently to make up for the defects in the description; the general construction of the apparatus, however, may be collected from the two; but we shall not dwell upon it, as it does not present any thing which, in our opinion, bespeaks it equal to several other machines for the same purpose, although it is the joint production of no fewer than four *inventors.* The articles to be shaved are laid upon a solid bench, and are forced to pass under fixed knives, by a lever, which is drawn against them by a badly constructed endless chain of iron, producing more than double the friction that is necessary. The claim is limited to this endless chain, and the cogged shaft by which it is to be drawn forward.

---

12. For *Distilling Alcohol from Apples;* Anson Walcott, Bloomfield, Ontario county, New York, October 6.

The pommage is to be put into a steam-tight tub, into which steam is to be admitted through a tube, which descends nearly to the bottom of it; a series of vessels, similarly connected by tubes, and perfectly resembling Woulfe's apparatus, is terminated by a condensing worm. The three last vessels, as represented, are to be hollow globes of metal, placed within open tubs, the water in which is to be sufficiently warm to keep the alcohol in the state of vapour, as, otherwise, it would condense in the hollow globes.

The claim is to "the application of steam in extracting alcohol from apple pommage, without first making it into cider, and the globular metallic condensers."

13. For a *Plough;* William Walker, Washington, Columbia county, Pennsylvania, October 6.

The claim is to "the peculiar formation of the sheath, or standard, and the projections on the inner side of the mould-board, which give the sheath, or standard, a leaning position, and cause the plough to take land."

14. For an improvement in the art of *Cutting, or Dividing, India Rubber;* William Atkinson, city of New York, October 6.

The improvement in the art, or process, of cutting India rubber, preparatory to dissolving it, consists in putting it into a machine, such as is used for the preparation of paper stuff, by the paper makers. The patentee says, "I do not claim to be the inventor of the machine employed by me, or any part thereof; but what I do claim is an improvement in the art of dividing, or cutting up, India rubber, preparatory to the dissolving thereof in any proper menstruum, either in the common paper machine, or in a machine made for the express purpose, and operating substantially upon the same principle."

15. For a machine for *Laying Ropes;* John Goulding, Boston, Massachusetts, October 10.

A machine for laying ropes of three or more strands is necessarily complex; the specification before us contains fifty-one references to the drawings, which fully exhibit the construction of the whole of the apparatus. The claim is to the combination and arrangement of the several parts, as described. There are several machines patented, both here and in England, the operating parts of which strongly resemble those which are the subject of the present patent; the combination claimed may, probably, be sustained, but we believe that the patentee must, in this case, limit himself to the precise modes described by him.

16. For an improvement in the machine for *Hatchelling Hemp, Flax, Tow, or Manilla Grass;* John Goulding, Boston, Massachusetts, October 10.

A patent issued to Mr. Goulding, on the 17th of August, 1835, for a machine for the above purpose, which he has since improved by the addition of a cylinder, which is said to render it more effective; to this addition, his specification and claim, under the present patent, are confined.

17. For a *Horse Power;* Moses Davenport, Phillips, Somerset county, Maine, October 10.

The claim under this patent is to "the method of construction, or combination, by which the several parts of the jointed platform are put together; of the cylinder heads, and of the friction rollers." This combination in most of its parts, exists in numerous other endless platforms; the peculiarities of the one before us, ought, therefore, to have been pointed out, as upon these alone could any valid claim be founded.

18. For a *Tin Oven;* Nathaniel D. Whitin, city of New York, October 10.

The oven, as represented in the drawing, is in the form of a common closet, with shelves; we are told, however, that it may assume various shapes, the claims made being to certain flat flues, and other appendages for conveying and regulating the heat, which are not, by any means, well described. The fuel is to be charcoal, and the furnace part, for receiving it, is to be so constructed that the combustion may, by an additional grate, be confined to the upper compartment of the shelved closet, or, when necessary, descend lower. The drawing is well enough as a picture, but it does not make the construction clearly known.

19. For a *Cooking Stove;* Elnathan Samson, Pierpont, St. Lawrence county, New York, October 10.

This stove is to be used as an open stove, when desired; but, like many others, it has doors in front, by which it may be closed. The oven, boilers, &c., are clearly described, and well represented, but there is an entire absence of every thing like a claim. We are told, however, that the improvements will be obvious from the description, and to the patentee this may be the case; he has erred, however, in not enlightening others, by designating these improvements, as the law requires he should do; obvious as they are said to be, we cannot point them out.

20. For a machine for *Hulling and Cleaning Clover and Timothy Seed;* Asa Burgess, and Herman Baldwin, Washington, Litchfield county, Connecticut, October 10.

Ten pages are devoted to the description of this machine, but our remarks upon it will be as brief as the specification is prolix. The feed is to be regulated by sliding boards, not differing essentially from such as are already in use. The seed is to be rubbed out by a revolving cylinder, furnished with points, or teeth; and below this there is a fan, so enclosed and constructed as to blow the chaff and dust away, without annoyance to the operator. The claim is sufficiently comprehensive, extending to many points in its construction, and also the situation in which it is to be placed in a building, for the purpose of blowing the chaff entirely out of it.

21. For *Applying Hydraulic Power;* Robert Mills, Washington city, and Henry B. Fernald, Portland, Cumberland county, Maine, October 10.

The rising and falling of the tide is to be employed for the purpose of condensing atmospheric air, which condensed air is to be afterwards applied, as a motive power, to machinery. The mode of condensing consists in placing a reservoir in the water, which shall rest on the bottom. This reservoir is to be open at bottom, to admit the water, but closed at top, to retain the air; the top is to rise to a convenient height above the line of high water; at this line there must be a horizontal partition, or diaphragm, furnished with valves, opening upwards, to admit the air as the water rises, and to retain it in the air chamber when it falls. This chamber is to be "provided with suitable *screw valves*, to admit of using the condensed air at pleasure;" it is to be "applied like steam." "In the falling of the water, there will be a vacuum created, or a tendency to that effect, in the air chamber, or room; and the atmosphere being admitted through a valve, opening inward, will rush with a force proportionable to the base of the air room, or chamber, and thus a power will be gained, in the falling of the tide, or water, which may also be employed to condense more air, or otherwise, by making the pressure of this air to work a wheel, or piston, as it enters the air chamber."

At p. 203 we noticed a patent, obtained, about two months since, by one of the above named gentlemen, for applying the rising and falling of the tide to the propelling of machinery, and showed that the plan then proposed was old, referring to a former patent for the same thing, and our remarks thereon. Although the mode there proposed is not, we think, likely to come into extensive use, there are situations where the power obtainable might be usefully applied; but if that now brought forward is intended as an improvement thereon, we are very certain that the thing will be "mended worse." To use the condensed air to advantage, would be an undertaking of great practical difficulty, and, in the present case, could not be effected, but by a very considerable loss of power; the patentees, however, have furnished us with no plan for doing this, and we will not attack windmills. We do not know, even, what they mean by "screw valves;" these are certainly novelties in mechanics. There is no point more clearly ruled than that a patent cannot be sustained for a principle, but only for the carrying of a principle into effect by certain means; but, in the case before us, no means are given.

---

22. For a *Washing Machine;* John O. Geer, Norwich, Connecticut, October 10.

A cylinder is to revolve, like a barrel churn; numerous pins, about an inch in length, are to project from the inner surface of it, and a number of round rods are to extend from head to head, within the cylinder, at such a distance from the surface as to allow water to pass. There are also rollers turning on pivots, to be similarly located. "The pins, rods, or rounds, and the roller above described, are claimed as the special property of the patentee." We do not think it worth while to dispute this claim.

---

23. For a *Machine for Making Staves;* George Pack, Sullivan, Madison county, New York, October 10.

This machine, it appears, is intended only for the jointing of staves, after they have been otherwise prepared, which jointing is to be effected by a long knife, reaching from end to end. The staves are to be first boiled, or steamed, to render them tender; they are then placed between jaws, embracing their ends, and advanced under the knife by a horizontal sliding table, moved by a rack and feed hand; the knife is to be forced down by lifters, operating under one end of a lever, to which it is attached.

The claim is to "the formation of staves from steamed, or boiled, wood, cut with an edge tool, or knife, after the manner, and according to the combination, above set forth," &c.

24. For improvements in *Constructing Rail-roads, and Regulating Cars thereon;* Roswell Bourne, Lancaster, Worcester county, Massachusetts, October 10.

A want of knowledge of what has been heretofore done in the construction of rail-roads, and also of the causes of the difficulties which it is proposed to obviate, are manifested in the specification of this patent. It is proposed to raise the outer rail on a curved rail-road, so as that "the inclination inward, or centripetal force, shall govern, or render equal, the centrifugal force, and thereby prevent the great friction of the outer wheel against the outer rail, which endangers the breaking of the axle, or wheel; your petitioner thus proposes to do away with the impediment, by graduation of the elevation of the outer rail to the angle [?] of the curve, and enabling the cars to maintain the same velocity of motion, as when moving in a direct course."

Rails have been elevated in the manner proposed, long since, for the purpose of lessening the friction of the flanch against it; but more effectual modes than this, founded upon more just principles, have been adopted, as will be seen by reference to James' patent, vol. iv., first series, page 317; Wright's patents, p. 270; and Stimpson's patents, pp. 269 and 278 of this volume.

---

25. For a *Gravitation Churn;* Asahel Bacon, Windsor, Broome county, New York, October 10.

There is to be a weight wound up as a maintaining power to a pendulum, a train of wheels and pinions to regulate the same, and there is a claim to "the propelling of vibrating or dasher churns, by means of a weight, or weights attached to a gearing of cog, belt or band wheels, or all of them."

---

26. For a *Rotary Steam-Engine;* Arnold Buffum, city of Philadelphia, October 10.

A cylinder twelve inches in diameter, and five inches deep, is to be made of metal. An oval block, twelve inches long, six wide, and four deep, or thick, is to be placed within the cylinder and two circular heads, half an inch thick, and exactly fitting the cylinder, are to be firmly attached to the oval block; an iron shaft passing through the centre, allows the block and heads to revolve. Two valves, each four inches square, are to be hinged on opposite sides of the cylinder, in which there are recesses to receive them, they being curved to adapt themselves thereto. The steam enters the chamber by opening against the centres of these valves, so that when they are closed by the passing of the oval block, no steam is admitted, but they are forced open by it as soon as the block ceases to press on them; there are, of course, two openings, properly situated, for the escape of the steam.

Those acquainted with the subject will at once see that the operation of this engine is dependent upon principles often employed in similar machines; in the arrangement we see nothing which is likely to render it superior to others of the same class, or to remove the objections generally existing against rotary engines. The claim comprehends the whole arrangement by which the machine is characterized.

---

27. For a *Doffer,* for carding machines; S. Parkhurst, Providence, Rhode Island, October 10. (See specification.)

28. For an improvement in the mode of constructing *Grates, or Grate Bars, for Furnaces;* Jordan L. Mott, city of New York, October 14.

This patent is taken for a convenient mode of constructing grate bars, so that they may vibrate and tilt readily when required, and in such a manner that they require no filing, or other fitting, but are ready for use as they are delivered from the mould in casting.

---

29. For an improvement in the manner of *Constructing Roads;* Thomas Earl, Burlington, Burlington county, New Jersey, October 14.

The road is to be levelled, then covered with gravel to the depth of two inches, and upon this tar is to be poured regularly; sand is to be spread over the tar, and allowed to remain until it is perfectly incorporated; in some cases the gravel may be omitted.

We have several times mentioned a like mode of making roads in this journal, and for years before its publication have pointed it out, and advocated it; the files of the patent office may be resorted to, to show that the present patentee is not the first inventor. To us it was suggested by the accidental staving of two barrels of tar on a common road, about twenty years ago; the place is a great thoroughfare on the main mail route through the United States, and we believe that the spot now remains apparently unimpressed by the passage of thousands of heavy vehicles.

---

30. For an improvement in *Cast Iron Window Sashes;* James S. Stoddard, Macedon, Wayne county, New York, October 14.

The improvement claimed consists in casting the stiles, and top and bottom rails hollow, by which improvement the muntins and uprights are preserved from cracking in the cooling of the metal.

The foregoing claim may be good, but we doubt it. Cast iron sash have been extensively used in England for many years, and it would be strange if for the purpose above named, and that of lightness, the stiles and rails had not been cast hollow, or so narrow as to give them the same substance with the muntins; had we made a pattern for casting sash, we should not have needed instruction or admonition on this point.

---

31. For improvement in the *Transhipment of Merchandise, on Canal and Rail Road Lines;* James O. Conner, city of Philadelphia, October 14.

This improvement consists in the construction of water-tight boxes, capable of holding about three tons of ordinary freight, and so shaped that they shall fit into canal boats, and also form the bodies of cars for transportation on rail roads. The boxes are to be lifted from one vehicle to the other, at the places of transhipment, by means of powerful cranes.

The claim is to "the principle of using large boxes, or car bodies, fitted to the interior of open canal boats, which boxes are to contain goods, or merchandise, for transhipment on rail roads, and on canals, without separating the contents of the boxes, or car-bodies."

---

32. For improvements in *Hanging Carriage Bodies;* Henry Pace, Senr., Cincinnati, Hamilton county, Ohio, October 14.

Various modes are described of carrying into effect the proposed plan, of hanging the bodies of carriages, the description of them being given at great length, the following constitutes the claim.

"*First.* To attach as many props and levers, of the denomination of 'the lever of the first kind,' as may be required for the use of any vehicle, or carriage, drawn or propelled by animal, steam, or other power. One prop for each lever may be fixed on any part of the running gear of the carriage that may suit its use or form, the lever to work free; the fulcrum to be placed at any part of the lever between the weight and the power, at the option of the builder.

Secondly. To attach one or more springs, or other applicable power, to each lever, one end of each spring, or springs, to be affixed either to the bottom of the body, or bed, or to the running gear; and the other end of each spring, or springs, or other power, to be attached to the end of the long arm of the lever so as to work free, or to the running gear.

"*Thirdly.* To attach the ends of the short arms of all the levers to the body shackles, or to the body, or carriage, (which is the weight) so that the levers and springs may work free when the carriage is in motion."

---

33. For a *Turning Lathe, to turn Rake Staves, Hoe Handles, &c.* James Haven, Newport, Sullivan county, New Hampshire, October 14.

If there is any thing really new in this lathe, the patentee has not enabled us to discover it; the object proposed, that of varying the form of the handle, or other article turned, according to a pattern, is a thing well known. The specification, without the aid of a good drawing, is insufficient for the intended purpose; and that which is called a drawing serves only to "make darkness visible." At all events, a lathe which would turn such handles most perfectly, may be constructed without violating the rights of any one.

---

34. For *Running Gears for Rail Roads;* George W. Cleveland, city of Baltimore, October 14.

The object of this invention is to admit of the vibration of the axles of the wheels, in such a manner as that the latter shall always conform themselves to the curvature of the road. Each wheel has its distinct axis, there being a centre pivot to sustain the end of each, which inner ends revolve in a vibrating bar, allowing the axis to vibrate horizontally. The outer ends of the axles run in bearings which conform themselves to the motion of the inner ends of the axles. The tread of the wheels is to be perfectly flat, without any cone, or rise, towards the flanches, and it appears that the wheels are to conform themselves to the direction of the rail by the action of the flanches upon them; a very short time will, we apprehend; demonstrate the worthlessness of this plan.

The particular construction of the parts require the drawing for a proper explanation of them. Upon these the claims are founded, and are also made to any other way in which "they may be constructed, so that by means of the same principles of action, the vibration of the semi-axles at their inner bearings, may be caused and regulated, so as to preserve the parallelism of the wheels, and permit them, by means of their flanches, to conform to the course of the rail-way."

---

35. For a *Stove for Burning Anthracite Coal;* Dennison Olmsted, New Haven, Connecticut; first patented, November 5, 1834; patent surrendered, and reissued, October 14.

The original specification of this patent is given at page 407, vol. XV; all that is further required, therefore, are the claims as now made, which are, 1st. Bringing the surfaces destined to absorb the heat, and transmit it to the apartment, so near each other, as to cause the heated volume of products from the chamber of combustion to come more closely into contact with said surfaces than has heretofore been done in structures more or less resembling this. 2d. Introducing into the apartment a continual current of warm air, by means of the air pipe, which admits cold air into the hollow space within the inner figure of the radiator; and this volume of air being rarified by heat within said space, that is, chiefly by circulating on the surface of said inner figure, flows out above, and is thus communicated to the apartment. 3d. Employing partitions, as before described, by means of which the said heated volume is made more effectually to traverse the absorbing surfaces.

---

36. For *Gimblets;* Orville B. Percival, East Haddam, Connecticut, October 14,

In this gimblet the pod is extended down to the end, or point of the screw, so that the threads are entirely on the back of it, the screw part itself forming a cutting edge, by which means it enters more easily into the wood, turns more freely, and with less than the ordinary tendency to split the stuff. Augurs, it is said, may be constructed on the same principle. From the specimen we have seen, we think that this gimblet possesses all the good properties ascribed to it.

---

37. For a *Washing Machine;* Henry Ault, Philadelphia, Monroe county, Tennessee, October 14.

A fluted cylinder is to revolve in a trough, and between this and rollers below it, the clothes are to be passed, by turning the cylinder, the gudgeons of the latter resting upon springs, and being drawn down by placing the foot upon a treadle. After they are cleaned, the clothes are to be pressed by passing them between rollers, the uppermost of which, also, may be borne down by means of a treadle.

---

38. For an improvement in *Fire Arms;* Samuel Ladd, Waltham, Middlesex county, Massachusetts, October 14.

This improvement consists in "overlaying fire arms with tin, or some compound metal of a similar nature, and thereby preventing the same from corroding with rust."

We do not believe that this process will ever come into general use, as the bright surface of the tin would be more objectionable than that of iron, which it has been found desirable to remove by bronzing.

---

39. For a Machine for *Cutting Felloes for Wheels;* John S. Brown, and Jacob J. Barker, Phillips, Somerset county, Maine, October 14.

We are told that this patent is taken for improvements upon a patented machine, of which the above named applicants do not claim to be the inventors. The original machine is fully described, but nothing is said respecting who invented it. The felloes are to be cut from plank by cutters projecting from the face of a segment wheel. The whole arrangement of the apparatus is given with sufficient clearness, but there is no summary of the things claimed as novelties. The right of the present patentees must rest, if they have any, upon their having become the possessors of the original patent, of which we know nothing. The improvements being matters of mere detail.

---

40. For a *Burr Stone Coffee Mill;* David Richmond, McArthurstown, Athens county, Ohio, October 14.

The claim is to "the making the bed and runner, in mills, of burr, or other stone, instead of iron, for grinding coffee, pepper and spices." We are satisfied with iron and steel, and doubt very much our ever seeing reason for changing them for stone in our coffee-mill.

---

41. For a *Machine for Cutting Felloes;* Winslow, Braley and Melzar L. Worthley, Phillips, Somerset county, Maine, October 14.

The machine here described is like that mentioned at No. 39, and we learn at the Patent Office that it is the one alluded to in that article. The only difference in them is in the mode of holding the timber to be operated upon, which Messrs. Brown and Barker think they have improved.

The patentees have not made any claim; we think, however, that there is sufficient novelty in the machine, upon which to found one.

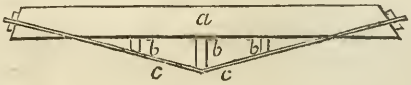
---

42. For *Bridges and Viaducts;* Richard T. L. Witty, Lowell, Middlesex county, Massachusetts, October 14.

We really do not understand what is meant in certain parts of the specification of this bridge; but we will afford a chance of doing so to others, by giving the whole substance of it. "I combine the lateral thrust or pressure of a beam to the catenary curve, which said curve may be formed of rods, wrought iron or other metal, and of chain or rope, &c. But I prefer rods of wrought iron. The curve of iron must be stretched from end to end of a beam of wood, and firmly bolted thereto, and passing over staucheons or other supports of wood or iron fastened to the beam, which said supports may be placed at suitable distances under the beam to form the catenarian curve, and the more firmly to retain it in its place. By this arrangement a very considerable strength of beam may be obtained for the making of bridges over rivers, canals, &c. and for the formation of viaducts to carry over rail-ways, in the construction of piers for docks or harbours, and for public buildings where considerable extent of beam may be required."

What is claimed are the invention, improvements, or methods, of making beams sufficiently strong for the formation of bridges, so as to extend them over rivers of great width, &c. and by heading the said beams with iron shields for that purpose, and to hold firmly the iron rods.

In the drawings, the *catenarian curve* is a straight beam, the *lateral thrust* of which is to be employed by the patentee; the accompanying sketch exhibits the manner of trussing a beam to form the said catenarian curve, as the patentee calls it. *a*, the beam, *b b*, the staucheons, *c c*, the iron rod.



43. For a *Spark Suppresser;* Haut C. Wiatt, Weldon, Halifax county, North Carolina, October 15.

This apparatus is to be used on locomotive or other steam engines. It consists principally of two tubes, one covering the other, and exceeding it in diameter about four inches; the inner tube is the chimney, the space between it and the outer is the reservoir into which the sparks are to fall; the outer tube is to have a cap with small perforations, allowing the smoke to escape, but detaining the sparks. The outer tube is made to raise and lower by means of a lever, for passing under bridges, &c. The claim is to this general construction.

---

44. For a *Cooking-Stove;* Horatio B. Wade, Cincinnati, Ohio, October 17.

The claim made is to "the manner of forming a fire chamber in a permanent and fixed situation, extending from one end to the other of the stove: and the application of the movable hearth to the door thereof, being an improvement upon the stove heretofore patented; having a movable fire chest, and without any hearth.

---

45. For improvement in *Anthracite Coal Stoves and Grates.* Patented October 25, 1832. Patent surrendered and reissued under an amended specification. Eliphalet Nott, Schenectady, New York, October 17th, 1835.

This stove was noticed, when first patented, at page 233, vol. XI, and to this notice we refer the reader, not deeming it requisite to make any remarks in addition to those there offered.

---

46. For *Preparing Skins for Tanning;* John C. F. Saloman, Reading, Berks county, Pennsylvania, October 17.

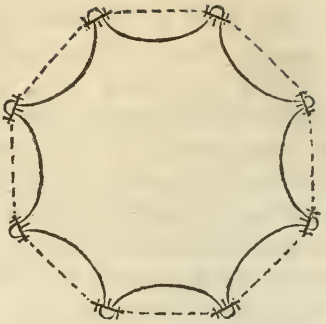
Instead of applying dung, after the skins have been limed to remove the hair, some diluted or weakened acid is to be used "in about the following proportions. To every ten gallons of water add two and a half ounces of concentrated acid. The skins are then immersed in this diluted acid, and occasionally taken out and washed in pure water" until the lime is dissolved out.

This specification is defective in not pointing out the kind of acid to be employed, as this is a point of no mean importance; it should be one which forms a soluble salt with lime, such as the muriatic. "Two and a half ounces of a concentrated acid," is also a very loose mode of giving directions, as different acids are not equivalent to each other under equal weights. The process, we have no doubt, is a good one.

---

47. For a *Safety Steam-Engine Boiler;* John C. F. Saloman, Reading, Berks county, Pennsylvania, October 17.

The claim under this patent is to "the principle of constructing boilers with inverted arches, so arranged as that their convex surfaces shall resist the pressure of the steam; and the surrounding of the boiler so formed by a cylindrical or polygonal casing, forming a chord to each arch the whole length of the boiler, and thus preventing the spring of the said arches; whilst at the same time the spaces between the cases and the arches thus formed, may serve as fire-places and flues for generating and conducting heat."



The sketch in the margin shows a transverse section of the boiler. Not only is the body of the boiler to consist of arched segments, rivetted together at their edges, but the heads also are to be concave inwards, so as to be pressed on by the steam in the manner of a dome.

Such a boiler would have a much less capacity in proportion to its weight, than one of the cylindrical form, and there would scarcely be a single point within it which, by yielding to the internal force, when not sufficient to rupture it, would not thereby enlarge its capacity.

The arched form, in a malleable, flexible substance, such as iron, will not operate in the same way with the stones in an arch of masonry; every indentation in the metal is a commencing point at which it may give way, and be followed by all the parts which surround it. Besides this, we see not how the places of juncture exposed to the action of the fire, and the metal forming the chord of the arches thus exposed, are to be kept from heating, and burning out. The thing at first view, is specious in its appearance, but it will not stand the test of examination; or the searching one of fire.

---

48. For a *Plough;* Junius S. Tefft, Amherst, Erie county, New York, October 17.

The claims are to "the manner of constructing and using the standard; of applying the landside plate, and the general combination of the parts."

---

49. For a *Washing Machine;* Isaac Spicer, Norwich, New London county, Connecticut, October 17.

A square box is to be made to revolve upon gudgeons; in a trough, within this box, there are to be pins projecting inwards; the claim is "to the construction of a machine in square."

Such square box washing machines have been long since patented, and are well known.

---

50. For *Glass Knob Screws;* Orrin Newton, Pittsburgh, Pennsylvania, October 17.

We are informed that "in the manufacture of this kind of knob screws, the head is cast in a mould on to a wire headed shank, in order to secure the *cast* head more firmly on; the sample herewith sent is made of a compound of block tin and copper, but may be made of any compound that may be cast in a mould; the great advantage of this kind of screw over all others is, its being easily cleaned, and always retaining its original colour, and is more quickly made;" nothing further is said upon the subject, yet, something more is evidently required; what information "the sample herewith sent" will afford to those who see the foregoing description, or who obtain copies of it from the office, cannot be seen; there ought to have been a drawing, as this shank head, and the casting upon it, admit of drawings, in which case the law requires them.

---

51. For *Cement for Cisterns;* William N. Carson and George Roberts, York, Livingston county, New York, October 17.

The following is the whole description. "Nine parts sand, three parts water-lime, one part plaster paris, and one quart muriate of soda; mix with water into a cement; to be applied to holes dug in the earth of any dimensions, for the purpose of holding water. What we claim as our invention is the addition of the plaster of paris and the muriate of soda (common salt) to the other articles."

The use of common salt, and of plaster of paris in such cements is not new, nor do we believe it to be of any use, as good hydraulic cement, made of the best water lime and sand, needs no improvement.

---

52. For an improvement in the *Machine for making Biscuit and Crackers;* Thomas Havener, and Thomas H. Havener, city of Washington, October 17.

This machine differs in a very trifling degree from others before used for the same purpose; the dough is to be rolled out between two metallic or wooden rollers, whence it passes on to an endless apron, carrying it under cutters and dockers worked up and down by a crank motion; the crank shaft standing above a sliding frame, or gate, to which the cutters are attached. On one end of the crank shaft there is a fly-wheel, and to this is attached a rod and feed hand, which operating upon a ratchet wheel, gives motion to the lower of the first named rollers; a toothed wheel on the axis of this roller acts upon the other parts by means of suitable gearing.

The claim is "the general construction of the above described machinery, with the arrangement of the several parts as described, but *particularly* the before described *ratchet or feeding wheel*, and *hand*, worked from the axis of the fly-wheel;" which claim is certainly much broader than the invention, the general construction, as before remarked, not being new; the part *particularly* claimed is a well known mode of communicating motion in machinery, and standing alone, is entirely without novelty, yet like other known modes of communicating motion, it might derive the requisite character by its making a part of a new invention.

---

53. For an improvement in *Calendering Cloth;* Zenas Bliss Johnston, Providence county, Rhode Island, October 17.

The improvement here patented consists in the addition of a roller above the three ordinarily used in calenders, by the aid of which additional roller the cloth is twice glazed in its passage between the rollers, thereby preventing the necessity of performing the operation a second time. In the ordinary calender, it is said that the boxes in which the gudgeons of the top roller run, last generally but sixty days, the weight having to be applied on them, whilst by the new arrangement, in which a large roller with a slow motion receives the weight, the boxes will last for two years.

---

54. For *Covering Buildings with Metallic Plates;* Phineas Burgess, Brooklyn, New York, October 17.

"The principle of this improvement consists in the lapping of the sides of the strips together with lap string pieces, with or without ribs, substantially as described." Were we to give the whole description, it would not afford a clear idea of the mode adopted by the patentee, without the aid of the drawing. We could make it intelligible by a verbal description alone, but cannot afford the space required. The object, of course, is to allow of the unobstructed expansion and construction of the metallic plates.

55. For a machine for *Cutting Crackers and Soda Biscuits;* William R. Nivins, city of New York, October 17.

An upright frame sustains the cutter which is to be worked up and down by the action of a descending weight, operating by means of a rope and pulleys, with a regulating wheel like that used in the common English roasting jack, all which is well enough shown. The patentee informs us that what he claims "is the movement of said machine, being entirely different from any other hitherto known."

56. For a *Machine for Cleaning Feathers;* George Reynolds, East Hartford, Connecticut, patented February 17th, 1834; patent surrendered and reissued, October 17th.

We described this machine in due course, page 176, vol. XIV. The object of the surrender was to make a claim, a thing entirely omitted in the first patent; it is as follows. "I do not claim, as my invention, the cylinder, the shaft, the pins, or indeed any several part of the machine taken by itself; but I do claim as my invention the combination of the several parts of the machine as described, and applicable to the particular objects aforesaid, and the manner of communicating the heat to the feathers by means of the revolving of the cylinder, presenting every side to the fire in rotation, and communicating the heat to every part of the feathers, as they are kept continually in motion by the dressing pins and revolving of the cylinder, and not liable to burn, or be overheated by continuing too long in one position."

57. For a *Planing Machine;* Reid R. Throckmorton, city of New York, October 22.

This planing machine is very much like that patented by the same person, on the 6th of October, see No. 4. A segment of a circle is to be suspended above the platform on which the board to be planed lies; from the face of the segment project four knives or cutters, the plank resting upon an iron bed, and being carried forward between rollers. The pendulous segment is to be made to vibrate backwards and forwards by a crank, and shackle bar. The claim is to "the peculiar construction of the plane and side cutters, moved by slides or guides and cranks, and resulting in a combined motion, reciprocating, rectilinear, and partly circular, in one operation, by connecting the end of the plane; by means of its handle, to a crank, or any other circular motion." The side cutters mentioned are, as in the former patent, for jointing, tongueing and grooving, and are to act like the upper segment. The remarks which we made upon the former patent, we should be disposed to reiterate, with the exception of acknowledging a little more clearness in the details, in the new specification. The present ought to have been taken for an improvement on the former: as it is, the two are essentially for the same thing, and both cannot stand.

58. For an improvement in the *Art of making Bricks and Tiles;* Benton P. Coston, Sterling, Wayne county, Pennsylvania, October 22.

This patent is not obtained, as the title indicates, for an improvement in the art of making bricks and tiles, but is for a machine for mixing, moulding, pressing and delivering bricks. The description, like the machine, is rather complex; the drawing is referred to throughout; a number of individual claims are made; and to these is added a claim to the general arrangement and combination. A copy of those claims would not be understood without the drawings, it would show, however, that they are not very limited in their character.

---

59. For a *Circumferenter, or Surveyor's Compass*; Samuel R. Miller, Port Royal, Frederick county, Virginia, October 22.

The claim made is to "an improvement on Francis Whitelly's compass, and consists in the arrangement of the several parts of the instrument described for taking angles."

The description is very imperfect, and the claim omits entirely to tell in what the improvement consists, an omission which, from the demands of the law. must be fatal. Who the Mr. W. is, whose compass has been improved, we do not know. It appears, however, from the specification and drawing, that the instrument here patented has a graduated semicircle, furnished with sights fixed upon arms on the chord of the semicircle produced. The needle is on a fixed arm, which is pointed, the point lying on the graduations of the semicircle, which latter, of course, moves with the sights, the degrees being read off at the point of the fixed arm.

---

60. For an improvement in the *Manufacture of Tubes and Hinges*; William Shaw, Buffalo, Erie county, New York, October 27.

The machine intended to be described is one for bending sheet metal to form the tubular knuckles of hinges; the description is a very imperfect one, and there is not any claim made; we think, however, so far as the materials before us will justify an opinion, that the machine is sufficiently original to be claimed as a whole. The sheet metal is to be passed in between two blocks of steel, and held in its place by a tightening screw; when, by turning a crank, the end of it is bent round a pin, which pin is to be pushed out by placing the hand upon a lever, thus forcing up a round punch, or wire, for that purpose.

---

61. For a *Morticing and Tenoning Machine*; John McClintoc, Chambersburg, Franklin county, Pennsylvania; patented October 8th, 1827; surrendered and reissued October 27.

The original patent was without any claim; it, however, described several things which have been claimed by others in patents subsequently obtained. We cannot now institute an enquiry into the originality of this and the other numerous morticing machines which have been patented at various times. The present claims are to the construction of the part which holds the chisel; the manner in which it is worked; the rack and pinion, that is the chisel rack and wheel; the mode of reversing the face of the chisel; the sliding table for bringing the pieces to be wrought into the proper place, the box which holds the stuff, and the manner of moving it; the round tongue on the chisel; the cutting sockets for Venitian shutters; the four-sided chisel; the double-cutting chisel; the treble-cutting chisel; the two-faced chisel; and the operating by treadle and spring.

---

62. For *Obtaining a Power for Propelling Cars, Boats, &c.*; Alexander M'Grew, Cincinnati, Ohio, October 27. (See specification.)

63. For a *Machine for Sawing Stone;* Daniel Bunnel, Zenia, Greene county, Ohio, October 27.

Saws are to be strained on frames, and fixed so as to run with a carriage having wheels upon suitable ways. The frames are to be moved by a crank motion. We are sorry that the patentee has omitted to tell what he claims, as we are entirely at a loss on this point, the whole, so far as we can perceive, being quite old.

---

64. For an *Apparatus for Boiling Sugar under a vacuum;* John Steele, Jr., city of New York, October 27. (See specification.)

---

65. For an improvement in the *Stone coal Stove;* Philip Benedict, Lancaster, Lancaster county, Pennsylvania, October 27.

This patent is said to be for an improvement on that of February 27th, 1830, noticed at p. 306, vol. v. The specification of the original patent was very obscure, and the present one is equally liable to the same objection; there is no other claim made than what is comprised in the information, that "the improvement consists in the lower oven, and manner of fixing the cylinder," neither of which are clearly described.

66- For *Ovens;* Jacob Baldwin, city of New York, October 27.

This patent is obtained for what must be esteemed a magnificent affair, as not only are ovens to be heated by anthracite coal, but, by means of the heated air, or *gas*, arising therefrom, houses and hotels, of the largest size, are to be warmed and *lighted.* "The inventor believes that the general use and application of his improvement will save our large cities from the repeated and heavy losses by fire, which from time to time occur;" and most assuredly he is correct in the conclusion, that, if they make all their fires by burning anthracite, in ovens of stone, or brick, and use no other light than that obtained from the gas arising from it, there will be little danger from the fire, and none from the lamps. The oven is to be built like a common bakers' oven; in one corner of it there is to be a grate, upon which the coal is to be laid and ignited, there being a draught hole beneath it. A flue, furnished with a damper, is to carry off the gas, which may be conducted wherever it is required for heating, or *illumination.* Upon these points there are, most unfortunately, no directions given, and we fear, therefore, that those who attempt to carry the plan into operation, especially the latter part of it, will *grope their way in the dark.* There is not any claim made.

---

67. For *Cutting Boots, Bootees, and High Laced Shoes;* Josiah T. Buck, New Canaan, Fairfield county, Connecticut, October 27.

We think that it will require a "cunning workman" to cut uppers for boots, &c., according to the proposed plan, without further directions than those given in the specification; all of which is comprised in the information, that the measure of the foot and leg are to taken in the mode now practised, the measure is to be laid on the leather, or cloth, to be cut; "when the upper for a boot is cut, it is but one piece of leather, with a slit on the vamp, and a projection for the top of the boot, making but one seam to close, and that a circular seam, running near the fore part of the boot, and ending at the bottom of the vamp, near the counter." There is neither a claim, nor drawing.

68. For a *Horse Collar Machine;* Caleb Angevine, city of New York, October 27.

The machine described is for blocking horse collars, a purpose for which several patents have been obtained within a year or two. A block, in the proper form, is to be bolted on to a bench, and a rope, passing round the collar, draws it to the block, said rope being wound round an iron shaft, turned by a wheel and pinion at one end of the bench. The patentee claims "the application of the cog wheels, cylinders, or shafts, hand crank, bolting the collar on the bench, hand lever, rag wheel, and stop, or catch, all as set forth in the specification." He probably might have extended his claim to the pair of hands by which he turns the crank of the pinion wheels.

---

69. For *Moulds for Loaf Sugar, &c.;* Charles Duncan, Williamsburg, Kings county, New York, October 27.

A concave mould, or chuck, is to be made, and fixed upon a vertical shaft, which is to revolve like a potters' wheel. It is proposed to form the inside of this mould, or chuck, of plaster of Paris. The prepared clay for making the sugar mould, is to be laid within the concave, and a *former*, of the shape of the inside of the mould, is to be made to descend within it, so as to shape and smooth it. The specification, though verbose and involved, may, nevertheless, be sufficiently well understood to enable a person to carry the plan into operation. There is no claim.

---

70. For a *Machine for Propelling Machinery;* David Russell, Tuscumbia, Franklin county, Alabama, October 27.

This is called "Russell's Power Motion Machine," and we suppose that it is intended to gain power, in some way, but how, we are not told, and cannot discover. A circular platform of wood, which is a flat ring, two feet wide, twenty in diameter, and four inches thick, rests upon steel springs; upon this platform, a heavy wheel is to roll, having a horizontal shaft geared into a vertical centre shaft, in the manner of some bark, drug, and other mills. The magic is, no doubt, in the springs, but we have no seer by us to unbind the spell.

The *combination and arrangement* are claimed, and we are told that "this machine may be used to propel all kinds of machinery, and may be propelled by steam, horse, water, or manual power."

---

71. For a *Portable Saw Mill;* David Russell, Tuscumbia, Franklin county, Alabama, October 27.

Strange as it may seem, this portable saw mill, although invented by the patentee of the *machine for propelling machinery*, is to be driven by a horse, geared to a shaft, in the usual way. A frame is made, which is to be moved about upon wheels, and is to sustain the various parts of the mill, which has nothing peculiar in its construction, excepting it be that the saw is not to be strained in a frame, but the upper end of it is to be acted upon by springs, which are to aid in raising it, in conjunction with the operation of the crank at its lower end. Respecting the use of springs, we refer to No. 8, p. 327; this application of springs is not claimed, nor, indeed, is any thing, excepting "the combination and arrangement of the several parts," which, when there is no novelty, is a convenient mode of slurring the matter over.

72. For an improvement in the *Gearing of Rail-road Carriages;* William T. James, city of New York, October 27.

The claim made will explain the object of this invention; it is as follows. "The application of wheels to rail-road carriages, by separate frames, in such a manner that they will traverse such segments of a circle as is required to conform to the curves of the road; the centre of which circle being placed on that part of the frame towards the centre of the carriage." Arrangements very similar to this have been the subject of previous patents, and as applied to two separate carriages of four wheels each, is in use in Winans' patented double cars, on the Baltimore and Ohio rail-road.

---

73. For a *Cooking Draw;* John C. Howard, Howard's Valley, Windham county, Connecticut, October 27.

A flat grate is to be set into a fireplace, and over this there is to be a drawer of metal, to slide in and out upon proper guides, or ledges. The claim "is a draw passing on grates into the chimney back, boiling and baking with the ordinary fire." The articles to be baked, boiled, or otherwise cooked, are to be put into this "draw."

---

74. For a *Cotton Whipper;* Lucian Osgood, Pomfret, Windham county, Connecticut, October 27.

"What I claim as my improvement, and by which the whipping machine for cotton is facilitated, and rendered more effective than heretofore, is the placing the whip shafts of such machines obliquely, so as to form an angle with the horizon, of twenty-five, or such other number of degrees as may be preferred."

---

75. For an improvement in the *Machine for Hulling Cotton Seed;* Anderson Miller, Washington county, Mississippi, and Thomas Laws, Jefferson county, Kentucky, October 27.

This machine is said to be an improvement upon that of Follet & Smith, but the whole arrangement of it is described, without any attempt being made to distinguish between the improvements, and the original machine. Much stress is laid upon the frame being of cast-iron, the gudgeons running in brass boxes, and all the parts of the machine being firmly made; there is also an eccentric roller described, by turning which the feed can be regulated. It should be recollected by the patentees, and by the purchasers of machines, or rights, that, excepting under the authority of Messrs. Follet & Smith, there can be no valid conveyance of the improved machine, any more than there can be of my house by a tenant, because he has improved it.

---

76. For an improvement in *Making Ploughshares and Coulters;* Samuel A. Sperry, Ann Arbor, Washtenaw county, Michigan, October 27.

The iron is to be rolled, as nearly as may be, into the proper shape; it is then to be converted into steel, and the shares, or coulters, are afterwards to be forged into such forms as may be wanted. The right to do this is claimed, which claim is one of a very questionable character.

---

77. For *Fastening Drawers;* Edward Brown, Lynchburg, Campbell county, Virginia, October 28.

We, some four or five years since, noticed a patent for a method of fastening a tier, or case of drawers, by one single lock, and mentioned a similar plan, by which we had, many years ago, effected the same object; the idea of doing so, however, we derived from a nest of drawers, imported from England; the plan now patented differs from those alluded to, but it is less simple, and not more efficacious. A rod is to extend up from the bottom to the top of the case, in a groove in one of its ends; this rod turns on pivots, and has a number of leaves projecting from it, equal to the number of drawers; when the drawer which has the lock on it is pushed in, it turns this rod, and brings the leaves to bear on recesses, or holes, in the sides of each of the other drawers. The claim is to the manner described of effecting this object.

---

78. For an improvement in the "*Circular Revolving Tenter Bars;*" Stephen R. Parkhurst, Worcester, Worcester county, Massachusetts, October 28.

We described the circular tenter bars at p. 19, vol. xvi., and the present patent is obtained for improvements thereon; these consist, mainly, in those arrangements which were deemed best adapted to the employment of steam to facilitate the operation of drying the cloth. The cloth, instead of being wound spirally, is coiled round upon circular tenter bars, usually forming three thicknesses from a whole piece. The circular tenter bars have heads to them, which enclose the apparatus, excepting at the centre, and the cloth, when wound, forms the periphery of a drum. Steam is admitted into the apparatus through a hollow axis, and circulates around wheels, the rims of which are hollow tubes, and extend out nearly in contact with the cloth, thus heating the air within the drum. Vanes, to agitate the warmed air, are placed within the drum, and a rapid revolving motion being given to the apparatus, the air is driven through the cloth, and it is quickly dried. The claims made embrace the new arrangement of the machinne.

---

79. For a *Planing Machine;* Ira M'Laughlin, and Hiram Hill, Sunderland, Bennington county, Vermont, October 28.

We shall not attempt to explain the particular devices adopted by the patentees for giving motion to the different parts of the machinery, (and to which their claims are confined,) as the whole apparatus appears to us to be very inferior to several others for the same purpose. The planing is to be effected by a plane of the ordinary construction, and the stuff to be planed, together with the bench on which it lies, are to have a reciprocating motion, the plane being at rest. There, manifestly, must be an enormous waste of power, in thus moving the heavier body backward and forward, instead of the lighter.

---

80. For a *Portable Stave Dresser;* Joseph Sweet, Murray, Lycoming county, Pennsylvania, October 28.

This patent appears to be taken for an improvement upon some other stave machinery, but what other we are not told. The staves are to be forced between knives, by means of followers, which have a toothed rack upon them, and are acted upon by a pinion. The knives are concave and convex, so as to dress each side of the stave, and as one follower rises, another descends, there being two sets of knives, or cutters. The claim made is to "the additional follower, and the mode of securing the guides." The forcing of staves between such knives, by similar means, is not new, nor is it claimed. If there is an existing right to the original machine, the improvement must be used in subservience thereto; we think it probable, however, that it is common property, as such knives have been long used.

---

81. For a machine for *Crushing and Grinding Corn;* Anderson P. H. Jordan, Madisonville, Monroe county, Tennesse, October 28.

The crushing is to be effected by a twisted bar of wrought iron, operating like that described by Oliver Evans, as used in mills for grinding plaster of Paris; from this twisted bar, the corn is to pass between a conical nut and shell, of the ordinary form. "The improvement consists in the uniting of the nut to the twisted bar, and upon this union the patent is claimed;" a union which may very well be dispensed with.

---

82. For a *Cement for Forming Pillars, Plastering Houses, &c.;* Charles Clinton, Minnisink, Orange county, New York, October 28.

Limestone is to be burnt until about two-fifths of it is converted into lime; to four bushels of this, when cool, four pounds of pearl-ash, and three pounds of alum, are to be added, and the whole ground fine; the composition is to be put into open barrels, and to remain there until the lime is perfectly slacked, after which it is to be mixed with water to a proper consistence, and used as a hard finish for walls; when rubbed down, it is to look like polished marble. For outside walls, about one-third part of sand is to be added. The composition may be variegated in its colours by the addition of proper materials for that purpose, and a variety of modes are suggested for varying the ornamental appearance of it. "Blocks, pillars, &c., may be formed of the cement, and, when sufficiently dry, may be plastered as before directed, and polished." Such are the general directions given, together with several variations, which we do not think it necessary to notice, as no claim whatever is made.

---

83. For a *Horse Power;* Asa Trahern, Henry Heberling, William E. Lukens, and John Heberling, Short Creek, Harrison county, Ohio, October 28.

This horse power is of the well known kind in which the animal, walking in a circle, is geared to a lever extending from a vertical shaft; at the lower end of this shaft is a crown, or bevil, master wheel, gearing into a pinion, or wallower, on a horizontal shaft, even with the ground. We cannot find any thing new in the affair; but the patentees claim "the eye of the master wheel and shaft, and the moving pinion, by which means, wood, pot metal, and iron, and, consequently, cost, are saved, and its utility greatly increased, whilst it is rendered much more portable." We are told that the master wheel "has a round eye, and runs on a round shaft." And the pinion by which the power is communicated at the outer end of a horizontal shaft, runs in a frame which may be moved round, so as to cause it to stand on any part of the periphery of the wheel which drives it. These, we suppose, are the things intended to be claimed by the four improvers of the horse power.

---

84. For a *Hill Side and Horizontal Plough;* John W. Jordan, Lexington, Rockbridge county, Virginia, October 28.

The claim made is to "the *combination* and *arrangement* of the parts of the described plough, but particularly the *form* of the mould-board, and the manner of reversing it, though no claim is made to the principle of revolving mould-boards." As respects "the *form* of the mould-board," it is said to resemble "two mould-boards of the M'Cormick pattern, (a right and a left hand,) united by their upper edges." There are numerous points of detail, showing, by reference to drawings, the particular manner in which the patentee constructs and connects the various parts of his plough, but nothing which bespeaks it superior to other hill-side ploughs, many of which have been patented.

85. For a *Gridiron;* Kellogg Strong, Meriden, New Haven county, Connecticut, October 28.

This is a rotary gridiron, very much, in appearance, like those already in use, consisting, like them, of two parts, the lowermost, or stand, being used to support the rotary bars. The thing claimed in this is the making the rotary part, which supports the meat, of very narrow flat bars, which allow the gravy to run on to the bars of the stand, which are fluted, and lead to a common receptacle, or gravy cup, from which they all radiate; in consequence of this construction, we are told that the juices run freely to the reservoir, the current not being disturbed by the rotation of the upper part.

86. For a *Machine for Cutting Saw Teeth;* Andrew F. Mervin, Muncy, Lycoming county, Pennsylvania, October 28.

The action of this machine for gumming saws, or cutting saw teeth, is so similar to that of many others, as to render it unnecessary to describe it, the main difference between them being in form only. The claims include parts which have no novelty, being to, "movable dies; the plate for holding down the female die; the screws and plate for regulating the stock; the regulator for determining the size and shape of the tooth, with the arrangement and adaptation of the several parts."

87. For an improvement in *Pumps;* Joseph Redelsperger, Mansfield, Warren county, New Jersey, October 28.

We have frequently remarked, that when we meet with a patent for improvements in pumps, we expect but little that is valuable and new, and we are compelled to say that the one now presented to our notice does not contain any thing to exalt it above its fellows. In its general construction, it is a common double-barrelled forcing pump, the parts of which do not offer any thing new, excepting it be two or three complex modes of working the pistons, which will ensure an abundant portion of friction. The claims made extend only to "the combination and arrangement of the several parts of the pumps, as above described;" and which combination and arrangement, were we about to erect forcing pumps, we would most carefully eschew.

88. For a *Rotary Pump;* Charles Peters, and Benjamin Deane, Poughkeepsie, Dutchess county, New York, October 31.

This rotary pump varies but little in its mode of action from others which have preceded it. There is to be a cylindrical case, with flat heads, and within this a smaller cylinder is to revolve, leaving an annular space between the two for the water chamber. Three valves are hinged, and shut into the inner cylinder, of which, when closed, they make a part of the periphery; they are forced into their places by a stop, or curved plane, which fills the capacity of the chamber in one point. When they pass this, they are forced out by pins, radiating from the centre, and in contact with their under sides; the pins are operated upon by a fixed stationary cam, in the centre of the pump. The water is not to be delivered from an eduction pipe on the periphery of the outer cylinder, as is usually done, but from the centre of one of the heads; to enable it to arrive there, perforations are made through the revolving cylinder, under the valves, this cylinder being hollow, and supported by arms. This latter arrangement makes a prominent part of the claim, and, so far as we know, is new, and, the patentee thinks, very advantageous; we, however, are unable to discover whence its benefits are to be derived. An important thing in every pump is to change the direction of the water as little as possible, and certainly this is not accomplished by the mode of delivery proposed. In other respects, this pump is liable to the general objections to those on the rotary plan, resulting from the accuracy required in their construction, and which, if at first attained, is soon lost by wear.

89. For a *Truss for Hernia;* Henry Reid, Augusta, Georgia, October 31.

We suppose, from the manner in which the application and use of this truss are described, that the patentee is a practitioner of medicine, as it displays both knowledge and judgment upon the subject to which it relates. The truss spring is, in all cases, to extend entirely round the body, and is to be furnished with two pads, one at each end, that which presses on the abdominal ring on the sound side being soft, whilst that on the ruptured side is to be of wood, adapted to the size of the patient, and in the form of a half egg, supposing it to be divided longitudinally. There is no claim made, but the patentee evidently proceeds upon the idea that springs passing round the body, and having a pad at each end, are novelties.

The patentee says that this truss "differs from Hull's and Marshe's, in the peculiar shape of the block by which the immediate pressure is made, and in the immobility of the blocks, and in the pressure being made by blocks, instead of pads, or cushions. It differs from Stagner's in having simply spring power, and that so adjusted to the parts as to retain its adjustment without the aid of belt, buckle, and straps, or any other means, except the spring power."

"What I claim as my own invention, and not previously known in the above described improved independent spring truss, is, that it passes from one abdominal ring, and maintains a permanently equable pressure on the soft parts above the brim of the pelvis on each side, without the aid of belt, strap, buckle, or any other appendages whatsoever; and I claim, also, the short curved spring passing from the groin to the umbelicus."

The patentee is in error in supposing that a truss spring passing entirely round the body, and having a pad at each end, is new; we have seen more than one of this kind; that patented by D. Weaver, of Baltimore, is described at p. 327, vol. xiii., where it is expressly stated that "the double spring is to be used whether the hernia be only on one, or on both sides; this latter truss has also two small pads near the middle of the spring, one to bear on each side of the spine; there is a hinge joint at the middle, connecting the double spring, and calculated to give extra freedom to its motion, which is, we think, a manifest advantage.

90. For *Ladies Metallic Hair Combs;* Nathaniel Bushnell, Middletown, Middlesex county, Connecticut, October 31.

The comb described is to have the top made of tin, and the teeth of iron wire; the upper ends of the teeth are to be soldered to the plate, the edges of which are to be bent over to secure them in their places. The comb is afterwards to be painted in imitation of shell, or otherwise ornamented. Much is said about claiming and not claiming, which results, as we understand it, in there not being any thing new, excepting the manner of securing "the end teeth," which is a trifling affair, not worth describing, although worth patenting.

---

91. For a *Tailors' Measure;* Frederick A. Fairchild, Columbus, Muscogee county, Georgia, October 31.

The claim made is to "the combination of the steel bands with the sheet-brass strips, by means of clasps, loops, and thumb-screws, adjustable together, and substantially as described."

The drawings of the steel bands, brass strips, and a number of graduated tapes, have a very formidable appearance, and seem sufficient to enable a surgeon to bandage every limb in a man's body. We take it for granted that the apparatus is a very perfect one, but cannot undertake to analyze it.

---

92. For an improvement in the *Steelyard Balance;* Christian F. Dahl, city of Pittsburgh, Pennsylvania, October 31.

The improvements claimed consist, first, in giving the suspensions a single bearing, by allowing them to pass into a slot, or mortise, in the beam, instead of embracing it on each side; and, secondly, in placing a screw vertically at the back end of the beam, with a ball, or nut, on it, by the raising or lowering of which, the sensibility of the beam may be increased, or decreased. We are not aware that any benefit will be derived from having a single bearing for the suspensions; the patentee says that the friction will be lessened, but such is not the fact, as that will be proportioned to the load, without regard to the length of the bearing, supposing the workmanship to be good. The patentee speaks of the ball, on the vertical wire, as though it afforded the means of adjusting the beam, but its effect will be only to raise, or lower, the centre of gravity.

---

93. For *Open Stoves, and Fire-places, for Warming Buildings;* Daniel Sutherland, Lisbon, Lincoln county, Maine, October 31.

This stove, or fireplace, is similar to those open stoves, from the top of which a pipe ascends, and passes into the chimney at any convenient height. In the case before us, there is to be an open and direct passage into the chimney in the ordinary way, and a pipe, or second flue, rising from the top of the stove. A valve, or sliding shutter, is so constructed that either of the flues may be closed by it, at pleasure, or both left partially open.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for an improvement in the Rearing of Silk Worms; Granted to GAMALIEL GAY, *Poughkeepsie, Dutchess county, New York, October 6th,* 1835.

To all to whom these presents shall come, I, Gamaliel Gay, of the town of Poughkeepsie, in the county of Dutchess, and state of New York, send greeting.

The hurdles for rearing and feeding silk worms upon, are, or should be, made on a horizontal, four sided frame, of convenient width and length, and bottomed with cane, or twine, either reticulated, or having interstices between each slat of the cane, or thread of twine; which meshes, or interstices, should be of such dimensions that the silk worm will lie and feed upon them, and the litter of the worms fall through.

Now, be it known, that I, Gamaliel Gay, have invented, and applied to use, a revolving apron, for receiving upon it, and removing, the litter of the silk-worms, which falls through the hurdles, as above mentioned. The specification of which new and useful invention, for receiving and removing the litter of silk worms, is as follows.

The revolving apron for a single hurdle is constructed by placing in a frame, or otherwise, at and immediately under each end of the hurdle, a roller, or cylinder, in length equal to the width of the hurdle; over these cylinders, or rollers, extending from the outside of the periphery of the one, over and around that of the other is affixed an endless apron of cloth, or other flexible substance, equal, at least in width, to the width of the hurdle. This apron being drawn tight around the rollers, and the ends fastened together, is made to revolve around both rollers, by turning them by a crank affixed to the axle of one of them, or by otherwise revolving the rollers. The endless apron being thus constructed, receives the litter from the hurdle as it falls through, which litter, by causing a semi-revolution of the apron, is removed from under the hurdles, and caused to fall in a heap at one and either end of the hurdles, and may be suffered to fall from the apron either upon the floor, or into a vessel placed at, and partly under, the end of the hurdle, and below the outer periphery of the roller.

In case two or more hurdles be placed in tiers, one above the other, the same apron may be used, in which case an endless and separate apron is required for each hurdle; but the best method, the most convenient and least expensive form of apparatus, and which I claim as a constituent part of my invention, is constructed as follows. Let there be rollers, or cylinders, affixed under each end of each hurdle, the same as in case of a single hurdle; to one roller, below the lower hurdle, attach one end of an apron, of the kind and proportionate width first above specified; let this apron pass under the opposite roller, over the roller next immediately above that, under the roller next immediately above the first roller to which the apron is attached, over the next above roller, and under the next opposite one; and so on according to the number of hurdles in the tier, until the apron reaches the last roller to which the apron should be attached, after adding to the length of the apron at least the length of one of the hurdles, which should be rolled upon the last mentioned roller. The apron thus passing under each hurdle, receives all the litter falling from each, which litter is discharged, part at one end, and part at the other end of the hurdles, by turning the first mentioned roller so as to wind over and around it a quantity of the apron equal to the length of the above hurdle, which winding causes an equal quantity of the apron to unwind from the roller to which the other end of the roller is attached; after the litter is thus discharged from the apron, the apron is, in part, to be again wound around the upper roller, as first above mentioned, so as to remain until the litter is again discharged.

What I claim as my improvement, and wish to secure by letters patent, in the rearing of silk worms, is the application of a revolving apron, or aprons, placed under the hurdles upon which the worms are fed, for the purpose of receiving and removing the litter falling from them; and this I claim, whether the same be made exactly in the way described, or in any other, operating substantially on the same principle, and by which a similar effect is produced.

GAMALIEL GAY.

Specification of a Patent for a Doffer for Wool Carding Machines. Granted to STEPHEN R. PARKHURST, *Providence, Rhode Island, October* 10*th*, 1835.

To all persons to whom these presents shall come, be it known, that I, Stephen R. Parkhurst, of Providence, in the county of Providence, and state of Rhode Island, and Providence Plantations, have invented a new and useful doffer, with corresponding rolls, for the wool card, called a finisher. Instead of a continuous cylinder, this doffer is composed of a set of wheels, or pulleys, of equal diameter with the common doffer, covered with a card in the same way, of three or four inches thickness at the rims, to revolve like the common doffer, placed upon their shaft, an inch, or an inch and a half, apart, and at a small angle and parallel with each other, and making such an angle with the shaft as that the spaces between may be fully compensated in their revolution, and the whole surface of the main cylinder be passed over by them; and their rims, or outer surfaces, must be parallel to their shaft, so as to conform to the surface of the main cylinder. Next, there is a set of pulleys, which I call division rollers; these may be about four inches in diameter, for a common doffer, of the same thickness with the spaces between the different rims, or pulleys, of the doffer, placed upon their shaft at the same angle, turned by a belt, or gear, placed before the doffer, with their shaft a little lower than the shaft of the doffer, and so placed that their outer edges will be a little within the rims of the doffer, for the purpose of keeping the wool on the different parts, or wheels, of the doffer, entirely separate, as it is taken off by the top rolls, hereinafter described. The next are a set of pulleys, or wheels, or rims, which I call the top rolls; they are equal in number to the different rims of the doffer, four or five inches in diameter; they may be a little less in thickness than the width of the different rims of the doffer, so that the division rolls may revolve freely between them, placed so as to revolve in contact with their correspondent rims of the doffer, for the purpose of taking the wool from it, and so placed as that they will so bear upon the shaft of the division rolls as to be turned by it. A comb, if necessary, may be attached to this doffer, to clear the wool from it. The wool taken from the doffer by these top rolls, kept in separate laminæ, or flakes, by the division rolls, drawn over the shaft of the division rolls, may be passed through a tube, or a belt, and then run on a spool, or spools; or, by a flyer properly placed, it may be at once twisted into a thread. By regulating the feed of the card, and the speed of the division rolls, the size of the roping, and of thread, i. e. the fineness of them, may be regulated, or adjusted, to suit the work required.

I claim as my invention, and not before known, the doffer before described, together with the top rolls, and division rolls, to correspond with it.

STEPHEN R. PARKHURST.

Specification of a Patent for Obtaining a Power for Propelling Cars, Boats, &c. Granted to ALEXANDER M'GREW, *Cincinnati, Ohio, October 25th,* 1835.

To all whom it may concern, be it known, that I, Alexander M'Grew, of Cincinnati, in the county of Hamilton, and state of Ohio, have invented, or discovered, a more economical mode of obtaining power for propelling cars upon rail-roads, boats upon rivers and canals, and effecting other objects, where such power may be wanted for the purposes of transportation, than has heretofore been adopted; and I do hereby declare that the following is a full and exact description thereof.

My improvement does not consist in the employment of any newly invented machinery, but in the using of such power from falls, or currents of water, or other natural or artificial sources of power, as has heretofore been allowed to run to waste, and employing the same for the purpose of condensing of air into suitable receivers; the elastic force of which condensed air is to be subsequently applied to the purposes herein designated. In numerous situations in the courses of canals and rail-roads, and of other roads and water courses, there are falls of water, waste weirs, dams, sluices, &c., the power from which, if economized, would be ample for the attainment of all the ends proposed by me; I bring this into use by taking the waste power from wheels, or other machinery already erected, or by erecting others where they do not already exist, using any of the known constructions of such wheels, or other machinery, as may be best adapted to the particular situations in which they are to be employed; these I connect in the ordinary way with the piston, or pistons, of condensing engines, constructed for the condensing of air, and force air thereby into suitable receptacles, or reservoirs, furnished with the requisite tubes, valves, or other appendages, by which they are adapted to the containing of the air thus condensed, and to the supplying of the same in measured quantities, so as to operate upon a piston for driving and propelling machinery, as high steam is now made to operate. The means of doing this does not require any description, being perfectly familiar to competent engineers. The air is to be condensed into one large stationary reservoir, and by means of a connecting tube and stop cock, transferred therefrom into other reservoirs connected with the vehicle to be propelled.

What I claim as my improvement in the art of propelling cars, boats, or other vehicles for transportation, is the employment of the waste power of water, wind, or other natural or artificial sources of power, to the condensation of air, in the manner, and for the purposes, hereinbefore set forth.

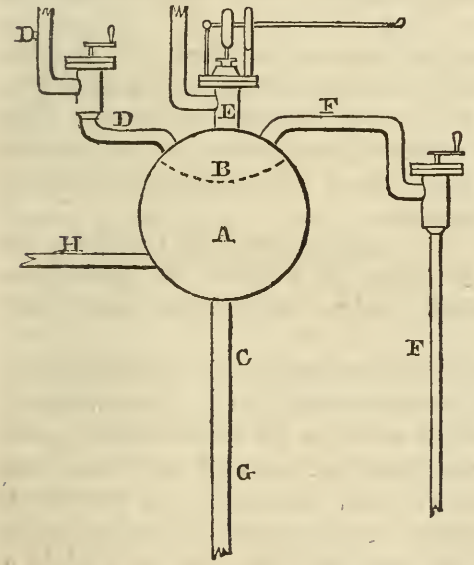
ALEXANDER M'GREW.

Remarks by the Editor.—It has been repeatedly proposed to drive railroad cars, &c., by means of condensed air, instead of by steam, and to erect stationary engines for the purpose of filling the requisite reservoirs, and we believe that the thing was attempted in England. Were there not serious practical objections to the plan, it would certainly present many advantages, but these are so weighty, that they are not likely to be removed. Among them is the perpetually diminishing power of the condensed air, as every stroke of a piston must lessen its elastic force; to graduate the quantity emitted from the reservoir, in proportion to this diminished force, would be very difficult; and, besides this, there ought, when the reservoir is renewed, to be a pressure of several atmospheres above what is required in a steam boiler, or it will soon be so far exhausted as to be inadequate to the production of the intended effect, as they would have to be exchanged whilst under a pressure of two or three atmospheres.

The present patentee does not propose to remove the foregoing, or any other objection to the use of condensed air, excepting it be the necessity of erecting stationary engines to effect the condensation; and to accomplish this, he depends upon the employment of means which would generally be more difficult, precarious, and expensive; in many places, the means of condensation proposed to be used would not be found within many miles of the stations where the reservoirs would be wanted, and there are, in fact, but few situations where the means of applying waste power would not be a costly undertaking.

Specification of a Patent for an Apparatus for Boiling Liquids under a vacuum. Granted to John Steele, Jr., *city of New York, October* 31*st* 1835.

To all to whom these presents shall come, be it known, that I, John Steele, Jr., of the city of New York, in the state of New York, have invented a new and useful improvement in the apparatus for boiling liquids, &c., under a vacuum, and that the following is a true and exact description thereof.



A, in the drawing hereto annexed, and to which I refer as part of this specification, is a large air-tight vessel, which may be made of any convenient shape, and of wood, or metal. B, is a colander, extending through the air-tight vessel A, in order to disperse a jet, or stream, of water into small drops, thrown in by the pipes D and F, which are constructed with proper cocks, or valves, for regulating the supply of water. E, is a safety valve. C, is a pipe of the proper length, the lower end of which is plunged in water. H, is a pipe from a steam boiler. In order to produce a vacuum, steam is let into the vessel A, through the pipe H, until the vessels are completely blown through, when the pipe H may be shut. A quantity of cold water is now thrown on the colander B, by the pipes D, or F, which instantly condenses the steam, and forms a good vacuum. The condensation water falls out at the pipe C, G. A pipe from the pan, or still, is introduced into the large vessel A, or any pipe connected with it; consequently, a vacuum is formed in the pan, or still, so connected. The pipes D and F, may be supplied with water by means of a force, or of any other, pump, or they may supply themselves, if the location be convenient.

What I claim as my invention, and not previously known, in the above described apparatus, is the boiling of sugar, or any other substance, under a vacuum, without using an air pump to produce that vacuum.

In witness whereof, I have hereunto subscribed my name, this twenty-sixth day of August, in the year one thousand eight hundred and thirty-five.
JOHN STEELE, Jr.

Progress of Practical and Theoretical Mechanics and Chemistry.

Report on the use of the Hot Air Blast in iron Furnaces and Foundries.

By A. GUENYVEAU, *Engineer and Professor in the Royal School of Mines.*

[Concluded from p. 139.*]

II. APPLICATION OF THE HOT AIR BLAST TO CUPOLA FURNACES, TO SMITH'S FORGES, &c.

The hot air blast appears to have been applied with great advantage, in England, in furnaces for remelting pig iron. The consumption of coke, per ton of iron, was reduced from 400 to 280 lbs., one ton of metal passing per hour. The blast was heated by an apparatus placed at the trunnel head. There are various advantages resulting from this application. The fusion of the metal takes place in about half the time required to melt it by the cold blast; it is thus less exposed to the injurious action of the blast, and while twice the quantity of iron can be melted in a given time, the quality of the material is better. It is further stated that the quality of the iron is improved by the melting, and that it is more easily cast, owing to its greater fluidity.

At Vienne, France, there are two cupola furnaces supplied with hot air. The apparatus is at the trunnel head, and consists of two bell-shaped vessels, through the interstice between which the draught is forced. This form of apparatus is decidedly bad, the alternate expansion and contraction of the parts renders it leaky in a very short time. The efficacy of the hot air blast is felt, however, even at this furnace.

In applying the heating apparatus at the trunnel head of furnaces, for smelting lead, copper, &c. care must be taken to protect the pipes from the sulphurous and metallic vapours, which, issuing from the furnace, would destroy them very rapidly.

The fan, or rotary, blowing machine is used in several establishments at Paris, Rouen, &c. for supplying cupola furnaces with air. This though a simple means of applying power, does not seem to be an economical one. Even when great velocity is given to the fans, the force of the blast is inconsiderable, but by increasing the opening of the blast-pipe, the quantity of air thrown in may be rendered very great. In one case at Rouen, by increasing the diameter of the tuyeres from 30 to 54 lines, the daily yield of the furnace was nearly doubled, and an economy of fuel (coke) of 20 per cent. resulted, the cold blast being used in both cases. At La Voulte the fan makes from 800 to 1000 revolutions per minute, and the pressure at the tuyere is only four-tenths of an inch of mercury. Three and a half to four inches is the ordinary pressure with other blowing machines. If the air were to be heated, this machine would be hardly applicable, as the friction in the tubes of the heating apparatus would tend materially to diminish the draught.

Unsuccessful attempts have been made both in England and France, to

[*] Translated for this Journal, by Prof. A. D. Bache.

apply the hot air blast to bloomery furnaces. The causes of failure are, however, not known.

A similar application to finery furnaces, using charcoal as fuel, has succeeded. Mr. Combes states that at Lausen, (in Wirtemburg) the blast is heated by pipes below the hearth of a finery furnace, and has its temperature raised to 390° Fah. With the cold air blast, they used 40 cubic feet of charcoal to produce 200 lbs. of bar iron, and the weekly yield of the furnace was 6,000 lbs. Now, with the hot air blast, they consume 30 cubic feet of charcoal to the two hundred pounds of iron, or about one part by weight of charcoal, to one of malleable iron; the weekly yield is from 7,200 to 7,800 lbs. On several occasions the consumption of charcoal per 200 lbs. of iron was as high as 36 cubic feet, which the workmen attributed to their using pig iron obtained by the hot air blast, which they considered more difficult to refine than that made with the cold blast.

This last conjecture is opposed to the experience at Konigsbronn, where they do not consider iron reduced by the hot air blast as difficult to refine. The economy of fuel by this method of refining, has been rather more than one-sixth, and the loss in rendering the iron malleable is diminished. This successful result is obtained by using the hot air blast in melting the metal, while it is decarbonized by the aid of the cold blast. This method of operating has been followed with success at the finery furnaces at Creusot and Decazeville.

I was present at some trials made upon a catalonia forge by an association of iron masters of the department of Ariege. These were entirely unsuccessful. In the last of them the consumption of coal was not greater than with the cold blast, but the iron was of very inferior quality.

The hot air blast has been applied to the smith's forge with success. The iron was brought more rapidly to a welding heat, and the loss by oxidation was less than with the cold blast. There was no gain in the consumption of fuel. This method will probably be found useful in the working of steel, but no experiments have yet been made of a decisive character.

On the Use of Raw Coal, or of Wood, in High Furnaces, &c.

In order to produce a high temperature in a furnace, it is obviously necessary that the fuel should be consumed rapidly, and should not give off when heated, any vapours or incombustible gases, to carry off heat. The air thrown in by the draught contains four-fifths of its weight of nitrogen, which becoming heated causes a waste of fuel; if in addition to this, vapourizable matters are present in the fuel, the loss of heat is greatly increased. Charcoal, coke, &c. make such hot fires because their volatile parts have been driven off by previous heating.

In high furnaces wood has been used to advantage, even in the smelting of iron, while it has failed in low ones. In the former the fuel descends slowly, and after having its temperature gradually raised, reaches the part of the furnace in which the blast is most operative. At this place the highest heat is to be found, and here the principal chemical changes take place. Thus in fact the fuel is gradually dried and carbonized before it reaches the place of greatest heat. If it were otherwise, the working of the furnace would be very unsatisfactory.

Experiment has proved the position just taken, however liable to objection it may seem on the score of the high heat which may be supposed, in every furnace, much above the tuyeres. It was found in the Hartz, by trial in a furnace of twenty feet in height, in which lead and copper ores were smelted, that the wood used as fuel came within six or eight inches of the tuyeres, without having been carbonized. The experiment was made by having small openings made at intervals in the stack, through which the progress of the operation could be examined. In this case the use of wood was abandoned, the furnaces being worked, as before, with charcoal.

A further proof of the same position may be drawn from the fact that raw coal, although substituted for coke, with advantage, in some high furnaces, has not been used in cupolas.

It is then absolutely necessary that the wood, or coal, should be converted into charcoal, or coke, before reaching the reducing part of the furnace. When this does not occur, and this is proved to be sometimes the case, the working of the furnace is unsatisfactory. The nature of the coal will produce different effects in the same kind of furnace. Thus at Alais a gradual deterioration in the working of the furnace resulted from the use of raw coal; at Creusot it was found necessary to mix the raw coal and coke in nearly equal proportions; in Scotland the hot air blast is required to enable them to use raw coal, while in Wales and at Decazeville they use raw coal with the cold air blast. The effect of the hot air blast is doubtless to facilitate the carbonization of the raw fuel. To use wood for the smelting of iron, even in high furnaces, it has been found necessary to dry it before charging with it. This is true both in the Russian furnaces, and at Plons, in the latter of which the hot air blast is used, and the wood is mixed with charcoal. It should be observed further, that resinous woods, easily charred, have been the only ones hitherto tried.

This reasoning shows also why the more or less perfect roasting of an ore, the more or less moist state of the materials of the charge, the more or less complete carbonization of the wood or coal, produce such important effects, even in the largest furnaces. It is plain that the temperature just above the point when the ore is reduced is low, since coal, or wood, is not charred, and that to this we must look for the reason why it is so difficult to use these combustibles in the raw state.

M. Lampadius, of Freyburg, in his essay "on the use of combustibles in their crude state,"* has shown how necessary it is to heat the wood, or turf, to a point near to that in which it begins to carbonize, before using it as fuel. He remarks that the cost of transporting wood or turf being, of course, much greater than the freight upon the charcoal from them, will prevent their use in many cases. Thus if it be supposed that there is a gain of twenty-five per cent in the quantity of charcoal, by using wood not carbonized, as was the case in the Russian furnaces, the balance would at Freyburg, be against the use of the raw material, on account of the cost of transportation. M. Lampadius concludes that when the material is at hand, or the cost of transportation low, uncarbonized wood may be used to advantage, in high furnaces, for smelting iron, if it has been duly dried; a result due to the heat given out in the combustion of the gases driven off from the wood, and to their reducing power.

The cause just assigned seems to me insufficient to explain the very great economy sometimes resulting from the use of the raw material; I consider the effect mainly due to the mode of carbonization, by which a much larger per centage of the carbonized fuel results than by the ordinary methods. The volatile parts of the fuel are driven off by the heated and incombustible gases passing through it, and there is no waste, by combustion. Being carbonized slowly, uniformly and without sensible waste, the greatest useful effect must result, and it is easily understood why a given weight of dry wood, or coal, may when thus circumstanced, yield a fourth, or even a half more charcoal, or coke, than it would by the ordinary method, and thus may be competent to reduce a fourth, or half more ore.

---

*Erdmann's Journal of Chem. and Technology, vol. XII. 1831.

It must be admitted however, that this explanation does not account satisfactorily for the very great advantage found in the use of raw coal, in the high furnaces of Scotland, with the hot blast, and at Decazeville with the cold blast. At Decazeville, coal more than replaces an equal weight of coke. Thus one part by weight of coke was used for the fusion of 1.131 of mixed ore and flux, and now one part of coal is used to 1.675 of ore and flux. This coal would yield but .38 ($\frac{3}{8}$ths) of its weight of coke, and melt therefore but .43 of mixed ore and flux. The causes assigned by M. Lampadius, are therefore probably correct, being necessary in addition to that just examined, to explain the various effects.

On the Causes of the Efficacy of the Hot Air Blast.

It is plain that if cold materials are introduced within a furnace, they tend to lower its temperature, while their own is raised. If then the fuel and the blast be heated before they act chemically, to a temperature nearly equal to that of the part of the furnace at which the combination takes place, this heated portion will be increased in extent, its temperature will be higher than it would be under other circumstances, and the amount of heat, therefore, available in melting the ore, &c. will be greater. In smelting furnaces the fuel and ore are always thus heated. This is not the case, however, with the blast. In fact it has hitherto been considered an advantage to have the air as cold as possible, that it might contain more oxygen in a given bulk, and experience showed, in conformity with this view of the matter, that blast furnaces worked better in winter than in summer, and better at night than during the day. The expansion of air by heat causing, under a given pressure, less oxygen to be thrown into the furnace, will produce a diminished consumption of fuel, and yield of metal. In wind furnaces, in reverberating furnaces, and generally in all where an ordinary draught is used, an increased temperature in the air diminishes the draught. It can only be increased by raising the temperature of the air in the furnace, by the use of a more freely burning fuel, by additional attention in firing, &c. The same difficulty occurs in the blast furnace, if the power of the blowing machine cannot be increased.

It so happens that at the very time the air is warmest, springs are lowest, and the condensation of steam most difficult, two facts which will explain why the working of furnaces, both as to quantity and quality, is better in winter than in summer. If the weight of air thrown into the furnace had been made the same in summer as in winter, by increasing the power of the blowing machine, and the area of the blast pipes, it is probable that the working would not have been worse, in the former season than in the latter.

An artificial heating of the blast should produce the same effects as that just alluded to, and it is by no means surprising that the efficacy of the hot blast has been doubted. It remains to be seen whence this efficacy results.

M. Dufrenoy* has, in his explanation of the advantages of the hot air blast, shown the difference between the quantities of heat introduced into the furnace with the hot and cold blasts, and in an assumed case has determined this difference to amount to about one-sixteenth of the heat evolved by the combustion of the fuel. Since less air is thrown into the furnace in using the hot blast, there is of course, on that account, less cooling effect to contend against than in the other case.

---

* Annales des Mines, vol. IV. This Journal, page 419, vol. XV.

M. Clement Desormes concludes by calculating from data in an assumed case, that the temperature within the furnace is increased between 270° and 360° Fah. by the heated air blast; an increase which he considers adequate to explain all the observed effects.

These theories are far from settling entirely, the question in an economical point of view. They suppose indeed, that the consumption of fuel in heating the air may be equal to that saved in the reduction of the ore, which is by no means the case.

I propose therefore to classify the observed effects, and to point out their relative degrees of importance, and their connexion with each other and with established physical principles.

The effect of heating air being to diminish its density, and the consequences of this being decidedly bad when the air is but slightly heated, why should a further increase of temperature, even with a diminished pressure and density, produce so great advantages? The explanation is that the temperature of the air has a most important effect on the intensity of combustion, and there is no doubt a point at which this effect begins, and another beyond which it would hardly be sensible. Observation confirms this explanation. Bars of iron are readily raised to a welding heat in a smith's forge, supplied with hot air, in half the time required by the cold blast, and as the same quantity of coal is consumed per day in both cases, the greater effect in the former can only result from an increased intensity of combustion.* In the most successful trials the air was heated to 370° and the diameter of the blast pipe not being changed, the quantity thrown in was actually diminished, and yet there was an increased consumption of fuel. It is then the temperature of the air, and not its density, which determines the intensity of the fire.

In the furnace, then, the fuel is burned to the greatest advantage; but, further, the heat thus produced is rendered most effective. There can be no doubt that, in order to the regular working of the furnace, the different layers of the charge must descend regularly and horizontally. By the hot air process, the fuel is more completely converted into carbonic acid, than in the old process; more fuel is consumed in a given place, the temperature of which is, therefore, higher than in the former case; and this place of intense heat is more extended. As consequences, a greater mass of ore is reduced in a given time by the same weight of fuel, and more refractory ores can be reduced.

The charges descend more slowly, probably, because it requires more time to consume a large quantity of combustible in a given place, than to burn it through a considerable extent of the furnace. The air being completely deprived of its oxygen in the lower part of the furnace, cannot consume any of the combustible higher up. The charges have all moisture, or gaseous matter, completely driven off by the hot gases passing through them, and arrive, duly heated, at the place where the most intense heating effects are produced. This diminished rate of descent is entirely consistent with an increased yield of metal, since the amount of ore in each charge is increased.

---

* Anthracite coal merely requires its temperature to be sufficiently raised to make it keep up the combustion by the heat which it gives out. Iron wire, to burn in oxygen, requires its temperature to be first raised, and may be burned in chlorine if first fired by the combustion of copper wire. Iron filings, finely divided, burn in the air, and in the experiments of Mr. Tyler, a fire was made in a smith's forge, from iron turnings, by raising the temperature with fine turnings. At last the whole burning mass was iron, and a welding heat was produced upon a bar thrust into it. [Trans.]

From the intense action referred to above, results a greater fluidity in the slag, a diminution in the quantity of flux, the possible use of more refractory ores, or an increased proportion of others in the charges, and the production of gray pig iron, by proportions in the charge in a furnace, which, before, would yield only white, or mottled, castings.

In conclusion, it may be remarked that some changes may probably be made with advantage in the forms of furnaces using the hot air blast. It is difficult to point them out, and their determination will require repeated trials, and with the precise ores and combustibles intended to be used in a particular case. I would suggest, however, especially where forged iron is to be made, enlarging the furnace at and above the boshes, diminishing, at the same time, the height of the whole furnace. This latter change is understood to have already been made with advantage, in certain furnaces using charcoal as a fuel.

Effect of Drawing, Rolling, Annealing, &c., of the Metals.—In a paper on the ductility and malleability of certain metals, and on the variations of density which they undergo by different operations, M. Baudrimont developes the following interesting facts.

At a temperature rather above a cherry red, iron wire remained three months, surrounded by charcoal, without cementation taking place. A white heat, in five minutes, gave the properties of cast-iron to a square bar of malleable iron, of four-tenths of an inch on a side.

Wires of copper, and of alloys of copper and zinc, are increased in diameter, and diminished in density, by annealing. The operation of rolling condenses the metals more than that of wire drawing. The density of iron and copper is greater, if the metals are heated before being passed through the rollers. The reverse is the case with alloys of copper and zinc. The density of the metals is greatest when drawn into very fine wires.

Wires may be increased in length in two ways, by a diminution in the area of their cross section, or by increasing the distances between their particles. When wires are lengthened in the manner last named, they return to their former length by annealing.

Hydrogen has an action on copper and silver, at high temperatures, which permanently separates their particles. On alloys of copper and zinc, and even of silver and copper, it has no such action.

Wires of different metals, which, after passing through the same hole in the wire drawing plate, have different diameters, acquire equal diameters by annealing.

The diameter of a wire increases, very slowly, by time, after passing through the wire drawing plate. Wires which have been bent, and then straightened, re-acquire a curvature.

Wires exposed to a high heat, lose a part of their tenacity. They require to be annealed in wire drawing, not to render them more tenacious, but to allow the particles to resume the positions from which they may again be displaced. The loss of tenacity is common to copper, iron, platinum, and the alloys of copper and zinc.

Brass wire approaches to iron in strength, while copper is inferior to it. Brass may be used instead of iron, where the latter would oxidate too rapidly.

The iron wires are given at strengths from 79,000 lbs. to the square inch to 127,600 lbs. The brass wires, from 78 to 87,000 lbs. to the square inch. Copper, from 38 to 44,000 lbs. The diameters of the least and greatest wires were, iron, .014 inch, and .205 inch; brass, .070 and .267 inch; copper, .019 and .285 inch.

The finer wires bear greater weights, in proportion to their areas, than the coarser ones, because the particles of the former are compacted through the whole cross section, while those of the latter, for a certain depth only, are thus forced together.—*Ann. de Chim. et de Phys.*

A short Remark or two on what is commonly called Dry Rot, by Charles Waterton, Esq.—Dry rot is a misnomer. This disease in timber ought to be designated a decomposition of wood by its own internal juices, which have become vitiated for want of a free circulation of air.

If you rear a piece of timber, newly cut down, in an upright position in the open air, it will last for ages. Put another piece of the same tree into a ship, or into a house, where there is no access to the fresh air, and ere long it will be decomposed.

But should you have painted the piece of wood which you placed in an upright position, it will not last long; because, the paint having stopped up its pores, the incarcerated juices have become vitiated, and have caused the wood to rot. Nine times in ten, wood is painted too soon. The upright unpainted posts, in the houses of our ancestors, though exposed to the heats of summer, and the blasts of winter, have lasted for centuries; because the pores of the wood were not closed by any external application of tar or paint; and thus the juices had an opportunity of drying up gradually.

In 1827, on making some alterations in a passage, I put down and painted a new plinth, made of the best, and apparently, well-seasoned foreign deal. The stone wall was faced with wood and laths; and the plaster was so well worked to the plinth, that it might be said to have been air-tight. In about four months, a yellow fungus was perceived to ooze out between the bottom of the plinth and the flags; and on taking up the plinth, both it and the laths, and the ends of the upright pieces of wood to which the laths had been nailed, were found in as complete a state of decomposition as though they had been buried in a hot-bed. Part of these materials exhibited the appearance of what is usually called dry rot; and part was still moist, with fungus on it, sending forth a very disagreeable odour. A new plinth was immediately put down; and holes, 1½ inches in diameter, at every yard, were bored through it. This admitted a free circulation of air; and to this day the wood is as sound and good as the day on which it was first put down. The same year, I reared up, in the end of a neglected and notoriously damp barn, a lot of newly felled larch poles; and I placed another lot of larch poles against the wall on the outside of the same barn. These are now good and well seasoned: those within became tainted the first year, with what is called dry rot, and were used for firewood.

If, then, you admit a free circulation of air to the timber which is used in a house (no difficult matter) and abstain from painting that timber till it be perfectly seasoned, you will never suffer from what is called dry rot. And if the naval architect, by means of air-holes in the gunwale of a vessel (which might be closed in bad weather), could admit a free circulation of air to the timbers; and if he could, also, abstain from painting, or doing with turpentine, &c., the outer parts of the vessel, till the wood had become sufficiently seasoned, he would not have to complain of dry rot. I am of opinion, that if a vessel were to make three or four voyages before it is painted, or done with turpentine, &c., its outer wood would suffer much less from the influence of the weather than it usually suffers from its own internal juices, which cannot get vent, on account of artificial applications to the pores. But still the timber would be subject to the depredation of the insect. To prevent this effectually, Mr. Kyan's process must absolutely be adopted; and it must also be adopted to secure wood from what is called dry rot, in places where a free circulation of air cannot be introduced. I consider Mr. Kyan's process perfectly unexceptionable. The long arrows which the Indians use in Guiana are very subject to be eaten by the worm. In 1812, I applied the solution of corrosive sublimate to a large quantity of these arrows. At this hour they are perfectly sound, and show no appearance that the worm has ever tried to feed upon them.

I have penned down these transient remarks by way of preface to others, which I may possibly write, at some future time, on decay in living trees.

Loudon's Architect. Mag.

New Spirit Lamp.—A new and convenient spirit lamp, with an eolipyle having a vertical jet, is described by M. Pelletan, as the invention of M. Breuzin, of Paris. The entire apparatus is placed on a neat tripod stand, arranged for holding the vessel to be heated. The wick of the lamp is hollow, and is raised or depressed by a screw and rack. Above the lamp is an eolipyle of a cylindrical shape, through the middle of which the flame of the lamp passes. The vessel to be heated being placed above the eolipyle, retains the full effect of the flame of the lamp. The jet pipe from the eolipyle passes downwards, and by a bend is introduced into the axis of the cylindrical wick of the lamp. The alcohol flame is thus entirely vertical, and the apparatus is much more convenient than the common eolipyle where the jet is horizontal. By using vessels properly arranged to economise heat, a pint of water may be boiled in five minutes, and at a cost of less than half a cent (at Paris.) In a common coffee biggin, the same quantity of water may be boiled for about a cent. (*Jour. Connaiss. Us. et Prat.*)

Application of Tannate of Gelatin to taking Casts from Medals, &c.—This substance is obtained by adding a decoction of gall nuts, sumac, oak bark, or other substance containing tannin, to a solution of glue or isinglass, in water. It is fibrous and nearly insoluble. When exposed to the air in thin layers, it hardens. When moist, it is elastic.

The substance which was found to give the best mixture for casts, was finely pulverized slate. Silica, emery, &c. give pastes which harden, and may be used for razor straps.

In making casts of the mixture of tannate of gelatin and pulverized slate, it must be left for a certain time in the mould, in order to preserve the impression. If, however, it is allowed to remain there too long, it adheres strongly. The only difficulty in the application is to ascertain the precise time required for due hardening.

This substance may replace bronze in ornaments, papier maché, card work, &c. *Ibid.*

Analysis of two varieties of Bronze.—These specimens were analyzed by M. Berthier. The first was intended for the manufacture of cannon, but proved of bad quality; its composition was ascertained to avoid the same proportions in other mixtures. It consisted in 100 parts, of copper 83.8, tin 15.7, lead 0.5.

The bronze used at Paris for the striking parts of clocks, was found to be composed in 100 parts, of 71 to 72 of copper, 26.56 to 27 of tin, 1.44 to 2 of iron. *Ann. des Mines, vol.* VII.

Sheathing of Ships with Bronze.—The sheathing of this metal has been found by experiment, to lose but half the weight, in a given time, which copper would have lost. The composition used for making sheet bronze is 91 of copper and 9 of tin. *Ibid.*

Durability of Acacia Wood.—It was found that in the mining galleries at Carmaux, (France) the oak timber used to support the sides and top of the galleries, decayed very rapidly, being affected by the dry rot. A comparative experiment was made with acacia wood, from which it resulted that the latter wood is much more durable than the former, when exposed in such situations. Oak timber decayed in three months, while the acacia was unacted upon, except at the sap-wood surface, in four years.

The lateral strength of this wood is about equal to that of Norway pine. *Ann. des Mines, vol.* VII.

Progress of Physical Science.

Experimental Researches in Electricity. Eighth Series. By MICHAEL FARADAY, &c. &c. *Phil. Trans., Lond.*, 1835.

(Abstract concluded from page 285.)

13. The actions of dilute sulphuric acid on the zinc plates of a galvanic circle, may be distinguished into two parts. one which acts directly on the zinc, evolving hydrogen on its surface, the other which "producing an arrangement of the chemical forces throughout the electrolyte present (in this case water) tends to take oxygen from it, but cannot do so, unless the electric current consequent thereon can have free passage, and the hydrogen be delivered elsewhere than against the zinc. The electric current depends altogether upon the second of these."

(*a.*) In the ordinary use of zinc in the galvanic battery, there is a waste of power amounting to all the chemical action which takes place when the (electrodes) poles are not united. This is placed in a strong point of view by recollecting that the proper oxidation of three and a half ounces of zinc should decompose nearly one ounce of water, and evolve about 2400 cubic inches of hydrogen gas.

(*b.*) When impure (common) zinc is used, this loss of power is greater than when pure zinc is employed. The metallic impurities forming small galvanic circles on the zinc, tending to convey the electricity back to the zinc.

(*c.*) Amalgamated zinc has no such defects. It decomposes the water of the acid solution only when the circuit is completed. It ceases to act as soon as the poles are separated, and hence economy of both metal and acid. The mercury probably acts by bringing the whole surface of the zinc into a uniform condition, so that one part has no more tendency to evolve electricity than another, and hence no discharges take place from one point of the metal to another. A battery formed of such plates has the powerful condition incident to rest renewed, by merely separating the poles. It soon arrives at a permanent condition, any oxide formed at the surface of the zinc plates, being removed as soon as produced.

14. The voltaic battery may, possibly, in its improved forms, become applicable to manufacturing purposes, for, by it, an equivalent of a rare substance may be obtained, at the expense of several equivalents of common ones, such as zinc, and sulphuric acid.

15. If a zinc and platinum plate, plunged into dilute acid, be connected, by wires, with two platinum plates, which are also immersed in dilute acid, the electricity evolved by the action of the zinc in decomposing water, cannot pass, unless the water in the second cup be also decomposed. A similar arrangement will be formed, if a cell, to contain dilute acid, have, on one side of it, a zinc plate; on the opposite, a platinum plate, connected, by a platinum wire, with the zinc; and, midway between these two plates, a second platinum plate; the water between the zinc and middle platinum plate cannot be decomposed, unless the electricity evolved can also decompose the water between the two platinum plates. Mr. Faraday calls this second platinum plate, against the sides of which, the hydrogen and oxygen are evolved, the interposed plate. From the action of interposed plates, he draws new proofs of the identity of electrical forces with chemical affinity. The facts, and their explanations, are as follows.

(*a.*) When dilute sulphuric acid was used in the cell, with one pair of plates, before alluded to, one interposed plate stopped the current. One interposed plate effectually stopped the current of two galvanic pairs, but allowed that from three to pass.

The distance between the interposed plates, and their size, did not vary the result. When nitric acid was added to the liquid between the interposed plates, the current from one pair could pass, and when also added in the cell, between the galvanic plates, the current passed freely. Muriatic acid produced a less effect.

The current does not pass in the first mentioned case, because the water in the interposed cell must first be decomposed, and this it cannot be, unless the zinc have twice the affinity for oxygen that hydrogen has, since these elements are to be separated from each other, both in the cell between the galvanic plates, and in the interposed cell. This explains why the current from two pairs of plates may pass feebly, while that from three has free passage. The affinity of hydrogen and oxygen for each other being the resisting force, and not the want of conducting power in the interposed fluid, the thickness of the interposed stratum is, within limits, not an element in the effect. When nitric acid is added to the liquid in the interposed cell, its oxygen combines with the hydrogen of the water, when decomposed, and hence an affinity is introduced to aid decomposition.

(*b.*) When two interposed platinum plates were used, they allowed a feeble current from five plates to pass, and none from four. When four interposed plates were used, a very feeble current passed; by the removal of one of them, a somewhat stronger current passed; and with only one plate, the current was little obstructed. The effect of successive interpositions appears, as it ought to be, very different.

(*c.*) In all these experiments, a very feeble current, at first was observed to pass, water conducting such a current as the metals do, but in an imperfect degree.

(*d.*) When zinc was used to form any number of interposed plates, no apparent retardation of the current resulted. The zinc, of itself, being able to decompose water. Amalgamated zinc plates, two in number, retarded the current, though a single one appeared not materially to affect it.

16. The strength of action of a galvanic battery declines, not only from the products of its own action, but, in certain cases, from the curious condition of metals, by which there is a tendency to produce a reverse current.

(*a.*) The effect of the combination of the acid used in the cells of a battery, with the oxide of zinc, explains the rapid declension of galvanic action, and the reason why stopping the current, or removing the plates from the acid, causes a recovery of energy.

(*b.*) The second cause of declension is illustrated by using a cell similar to that described for investigating the effect of one interposed plate. A platinum wire, joining the exterior and interior platinum plates, was found by the galvanometer to have a powerful momentary current passing through it, at the instant of joining the plates, and in a reverse direction to that produced by the galvanic circle.

(*c.*) This peculiarity is traced as the cause why an interposed plate of copper at first allowed the current from one pair of plates to pass, and afterwards appeared to stop it. By turning the copper plate round, so as to change the directions of the exposed surfaces, the effects were reversed.

(*d.*) This same condition explains why a battery of platinum and copper plates, with dilute sulphuric acid, is competent to act only for a short time.

On Springs, Artesian Wells and Spouting Fountains, by M. Arago. By artesian wells are meant those of which the waters rise to or above the surface, on boring to a greater or less depth. They were known to the ancients, exist in the deserts of Sahara, as well as in the fertile plains of Southern France. They are called artesian from the Latin name of the county of Artois, in France.

M. Arago examines the following questions, and derives the conclusions which are stated.

1. Whence is the water of these wells derived? Not by filtration of sea water. Not by the evaporation and subsequent condensation of subterranean waters, but by the filtration of rain water until it reaches strata which prevent further progress. A recent guaging of the Seine has shown that but one-third of the water which it receives from rain, &c. reaches the sea, leaving two-thirds to be accounted for by evaporation, by that consumed in the support of vegetable and animal life, and by filtration.

2. How does this filtered water exist and circulate in the various formations which compose the earth's crust? In primary rocks springs are found to be small, and the issues are near the sources of the water. The stratified rocks of the secondary formations afford excellent floors for the passage of subterranean waters. They sometimes form basins, in some of which water collects. In the secondary strata springs are more rare than in the tertiary, but give more water when struck.

3. What power raises the water of artesian wells to or above the surface? Hydrostatic pressure. The water-bearing strata form reversed syphon-shaped interstices, and the pressure of the water in one branch raises the water in the other. In Artois this pressure must be transmitted sometimes more than one hundred miles.

M. Arago developes the following among other interesting facts.

The temperature of the water in these wells is uniformly higher than that of the surface at which they escape.

One of these wells in France, made in excavating for coal, is 1000 feet deep. Chiswick spring is supplied by a well bored to the depth of 582 feet. A well in the department of Pas de Calais throws its water to the height of seven feet above the ground, and is 461 feet deep.

Unpleasant effects upon the system at great heights.—The vertigo and other disagreeable sensations experienced at great elevations are due, according to M. Boussingault, the intrepid traveller who has recently ascended Chimborazo, (1831) to the exertion of the lungs in speaking. At the height of three miles they found the air nearly saturated with moisture, the thermometer being at $\frac{3}{4}$ of a degree of Fahrenheit's scale, above the freezing point of water. The cracking of the skin is not due then to the dryness of the air. It is to be explained by the excessive quantity of light reflected from the snow and ice, and to be guarded against by a veil of gauze or crape, of suitable colour.

M. Boussingault and his companions attained the height of three miles and three quarters above the level of the sea.—*Ann. de Chim. et de Phys.*

Comets shine by reflected light.—M. Arago considers himself entitled to infer, positively, from observations made during the recent return of Halley's comet, that this body, like the planets, derives its light from the sun.—*Jameson's Journal.*

Aurora Borealis, of October 18th, 1835.—It will be remembered that a very splendid display of the aurora was seen in the United States, on this evening, and a less brilliant and extensive one on the 19th. The aurora was seen throughout Great Britain on the same evening. At Paris, where the weather was cloudy, the magnetic needle was considerably disturbed on the 17th, 18th and 19th of November. At Nismes, in France, there was a brilliant aurora seen on the 18th.

Mechanics' Register.

Water-Proof Fabric.—The following composition for rendering cloth, paper, &c. water-proof, is the subject of a recent patent in England. Dissolve half an ounce of isinglass in a pound of soft water. Dissolve one ounce of alum in two pounds of water. Also one quarter of an ounce of soap in one pound of water. After straining each solution, if necessary, to separate impurities, mix them, and simmer over a fire for a short time. The liquid is to be used hot.

This liquid is considered applicable to cloths; for lighter fabrics the proportions and ingredients are varied as follows. One quarter of an ounce of isinglass to a pound of water. Three ounces of alum in three pounds of water. Half an ounce of soap in an ounce and a half of oil of turpentine, and mix it with a pound and a half of water. One ounce of fine glue in a pound of rain water. One ounce of gum arabic into half a pound of water. The alum, glue and gum, after being separately dissolved, are to be mixed and some time afterwards the soap is to be added. The ingredients to be mixed hot.—*Lond. Rep. Pat. Invent.*

Magnetic Locomotive Engine.—A very successful trial of a locomotive impelled by magnetic force, is *said* to have been made by M. Lemaire, of Brussels.

Prize Chronometers.—The first prize of £200, for chronometers, deposited, and under trial at the Greenwich Observatory, has not been awarded during the past year.—*Arcana of Sc.* 1835.

Birmingham Organ.—This very large and powerful instrument has been put up in the town hall of Birmingham. The space occupied by it is 35 feet in width, 15 feet in depth, and 45 feet in height. There are four rows of keys, and sixty stops. The largest pipe has a capacity of 217 cubic feet. The town hall will seat between three and four thousand persons. —*Arcana of Sc.* 1835.

Preservation of Plants in Brine.—Strong brine is stated by a correspondent of the Linnæan Society, to preserve plants, without affecting their colours.

Vapour Cave at Pyrmont.—A cavern has been excavated near the celebrated springs of Pyrmont, in imitation of the Grotto del Cane, near Naples. The air at the bottom of the cavern contains in one hundred parts, 48 of carbonic acid, and 52 of atmospheric air, by measure.—*Arcana Sc.* 1835.

Cultivation of Beet in France.—Two acres and a half of good land produces 47 cwt. 36 lbs. of beet root. From 100 lbs. of which seven or eight of saccharine matter is obtained, a part of which is molasses, the rest sugar. The pulp remaining, after extracting the sugar, affords a nutritious food for cattle.—*Arcana of Sc.* 1835.

Insects destroyed by Chamomile.—This herb, either in decoction or powdered, will destroy insects upon plants; even the growing herb has this effect.

New Journal of Popular Science.—The Society for the illustration and encouragement of Practical Science, well known for their exhibition room, the Adelaide Gallery, London, have undertaken a "Magazine of Popular Science, or Journal of the Useful Arts," of which the first number appeared on the first of February last.

List of American Patents which issued in February, 1836.

		February
41.	*Peeling apples.*—John W. Hatcher, Bedford county, Virginia,	3
42.	*Cooking stove.*—R. G. Cochran, Francistown, N. H.	3
43.	*Ropes and cordage.*—William Fanning, New York,	3
44.	*Cooking stove.*—Daniel Williams, Scaghticoke, N. Y.	3
45.	*Cultivator.*—James M. Garnett, Loretto, Virginia,	3
46.	*Shelling corn.*—Isaac A. Hedges, Elmira, N. Y.	3
47.	*Oven.*—Samuel Pollard, Orono, Maine,	3
48.	*Saw mill.*—George W. Black, Montgomery county, Tennessee,	3
49.	*Straw cutter.*—Isaac O. Wright, Elbridge, N. Y.	3
50.	*Mowing, thrashing, &c. machine.*—E. Briggs and G. G. Carpenter, Fort Lovington, N. Y.	5
51.	*Saddle tree.*—Andrew R. McBride, Williamson county, Tennessee,	5
52.	*Horse rake.*—Joseph W. Webb, Mount Morris, N. Y.	5
53.	*Smut and hulling machine.*—Samuel Richardson, Elmira, N. Y.	5
54.	*Tobacco press.*—A. M. McLean, Russelville, Kentucky,	5
55.	*Horse power.*—Dudley Marvin, New York,	5
56.	*Churn.*—Hezekiah Roberts, Seneca Falls, N. Y.	5
57.	*Bark, &c. for tanning.*—Daniel Williams, Boston, Mass.	5
58.	*Cotton Gin.*—W. and J. McCreight, Winsborough, S. C.	5
59.	*Grist mill.*—W. and J. McCreight, Winsborough, S. C.	5
60.	*Locomotive engines.*—H. R. Campbell, N. L. Philadelphia,	5
61.	*Bee hive.*—J. M. Hubbard, Canterbury, N. H.	5
62.	*Patterns, &c. for casting.*—Lewis H. Maus, Danville, Pennsylvania,	5
63.	*Thrashing machine.*—Lewis H. Maus, Danville, Pennsylvania,	5
64.	*Saw mill saw.*—B. K. Barber, Johnsburgh, N. Y.	5
65.	*Blood, equalizing the*—S. R. Terrell, Burton, Miss.	5
66.	*Mortice locks.*—P. and E. W. Blake, New Haven, Connecticut,	5
67.	*Flour cooler.*—Josiah Pope, Windham, Maine,	5
68.	*Fermenting and distilling.*—Joseph Stowell, Manchester, N. H.	5

69. *Cramping boot legs.*—William Gerrish, Poland, Maine, 10
70. *Gun locks.*— Samuel Morrison, Milton, Pennsylvania, 10
71. *Twain water wheel.*—William L. Elgar, Winchester, N. H. 10
72. *Planing machine.*—Melzer Tuells, Milo, N. Y. 10
73. *Shelling corn.*—Henry G. Neale, Poultney, Vermont, 10
74. *Straw cutter.*—C. D. Skinner and D. Read, Haddam, Connecticut, 10
75. *Churn.*—Lyman Whittier, Vienna, Maine, 10
76. *Straw cutter.*—Joseph Everod, Geneva, N. Y. 10
77. *Thrashing machine.*—Thomas Beede, Sandwich, N. H. 10
78. *Grate and cooking stove.*—John J. Giraud, Baltimore, Maryland, 10
79. *Molasses faucet.*—Charles W. Pickham, New Haven, Connecticut, 10
80. *Spindle and flyer.*—Willard T. Eddy, Ithaca, N. Y. 10
81. *Slide valve.*—A. McCausland, jr. Philadelphia, 10
82. *Crane.*—Elias Marsh, Oswego, N. Y. 12
83. *Piano forte.*—John Pettrick, New York, 12
84. *Boats.*—Edward Fitzpatrick, Mount Morris, N. Y. 12
85. *Churn.*—John E. Thomas, Winchester, Ohio, 12
86. *Horse power.*—Joseph Mustin, Franklin county, Vermont, 12
87. *Feathers, cleaning, &c.*—Daniel K. Hall, New York, 12
88. *Door fastenings for cars.*—John K. Smith, Port Clinton, Pennsylvania, 12
89. *Feathers, dressing.*—Samuel Keplinger, Baltimore, Maryland, 12
90. *Washing machine.*—Luther Davis, Norwich, Connecticnt, 12
91. *Drying cotton, &c.*—John Philbrick, Cold Springs, Miss. 12
92. *Blow-pipe for furnaces.*—John Barker, Baltimore, Maryland, 12
93. *Sliding grate.*—John C. Howard, Hampton, Connecticut, 13
94. *Shelling corn.*—Ira Smith, Downingtown, Pennsylvania, 13
95. *Screws, making.*—William Keane, Monroe, N. Y. 13
96. *Fanning machine.*—D. Flanders and C. Rathburn, Fort Covington, N. Y. 13
97. *Sausage meat cutting.*—Ambrose Henkel, New Market, Virginia, 13
98. *Hydraulic dock.*—Zebedee King, New York, 13
99. *Belt saw.*—William Carey, Poughkeepsie, N. Y. 17
100. *Cannon for chain shot.*—Edward Gordon, Hingham, Mass. 17
101. *Hulling clover seed.*—J. B. and W. F. Pougue, Lexington, Virginia, 17
102. *Bolt for mail bags, &c.*—Ira Atkins, Hanover, N. H. 17
103. *Mortice latch.*—William Coover, Erie, Pennsylvania, 17
104. *Spark catcher.*—Abraham McDonough, Philadelphia, 17
105. *Puppet valves, raising, &c.*—W. Duff and T. Murphy, Baltimore, Maryland, 17
106. *Tire for wheels.*—James H. Rogers, Mount Morris, N. Y. 17
107. *Rice starch.*—W. and T. Liversidge, Dorchester, Mass. 17
108. *Rotary steam engine.*—Aaron Clark, Bangor, Maine, 17
109. *Truss for hernia.*—William Adair, Pleasant Hill, Kentucky, 17
110. *Paper making machine.*—Charles Forbes, E. Hartford, Connecticut, 20
111. *Glasses for spectacles.*—Isaac Schnaitman, N. L. Philadelphia, 20
112. *Sawing staves, &c.*—A. Band and S. Heywood, Lunenburg, Mass. 20
113. *Salt, supplying.*—Peter Cooper, New York.* 20
114. *Pumps, suction,* &c.—Thomas C. Barton, Washington, N. J. 20
115. *Flyers for spinning.*—Samuel Ladd, Waltham, Mass. 20
116. *Saw mill,* cross *cutting.*—Rufus Riker, Dexter, Maine, 20
117. *Curing sores.*—Reuben Rood, Centre Lisle, Brown county, N. Y. 20
118. *Time-pieces.*—William Pardee, Poughkeepsie, N. Y. 20
119. *Still.*—John Wright, New York, 20
120. *Thrashing machine.*—James Cooper, Greene county, Ohio, 20
121. *Winnowing machine.*—David Wilson, Johnston, Vermont, 20
122. *Injecting syringe.*—Joseph Ralph, New York, 25
123. *Truss for hernia*—Francis H. Newman, Huntsville, Alabama, 25
124. *Lathe for gun stocks,* &c.—Abner Town, Woodbury, Vermont, 25
125. *Sawing,* &c. *by lever power.*—Jeremiah Walker, Phillips, Maine, 25
126. *Cooking stove.*—B. and A. Titus, Marshal, N. Y. 25
127. *Pump, vibrating.*—Sampson Davis, Derby, Vermont, 25
128. *Spark catcher.*—Francis Milo, New York, 25
129. *Smut machine.*—Abraham Mudge, Canajoharie, N. Y. 25
130. *Saw mill.*—David Washington, Peru, Mass. 25

*Suspended, but registered by mistake.

131.	*Bee hives.*—Ebenezer Beard, New Haven, Maine,	25
132.	*Pressing water from clothes.*—Caleb Angerine, New York,	25
133.	*Cotton gins.*—Henry Clark, New London, Connecticut,	25
134.	*Floom gate.*—Harvey Frink, Chatauque county, N. Y.	25
135.	*True meridian, finding,* &c.—William A. Burt, Mount Vernon, Michigan,	25
136.	*Saw mill dogs.*—Martin Rich, Ithaca, N. Y.	25
137.	*Saw mill dogs.*—Phineas Bennett, Ithaca, N. Y.	25
138.	*Fire arms.*—Samuel Colt, Hartford, Connecticut,	25
139.	*Boot tree.*—Matthew Matthews, Wayne county, Ohio,———	25
140.	*Stove or fire-place.*—C. Hendrick and W. Elwell, Gardiner, Maine.	25

CELESTIAL PHENOMENA, FOR JUNE, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
22	11	15	Im. *k'* Virginis,	,6,	N. 109	V. 157
22	12	0	Em.		195	245
28	14	47	Im. τ Sagittarii,	,4,	79	106
28	15	54	Em.		305	341

Meteorological Observations for February, 1836.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches			Inches.	
	1	11°	12°	29.50	29.60	W.	Blustering.		Clear day.
☼	2	.1	9	.80	.84	SW.	do.		Clear—lightly cloudy.
	3	.3	83	.90	.90	W.	Calm.		Clear—flurry of snow.
	4	3	11	.90	30.00	W.	do.		Clear day.
	5	2	9	30.10	.10	W.	Moderate.		Clear day.
	6	0	15	.10	.20	W.	do.		Clear day.
	7	16	31	.20	.15	E.	Calm.		Cloudy—snow.
	8	33	36	29.70	29.60	SW.	do.		Rain—cloudy.
☾	9	24	39	.63	.63	SW.	do.		Clear day.
	10	31	36	.90	30.00	W.	do.		Clear day.
	11	20	32	30.25	29.90	WNW.	do.		Clear—cloudy—snow in night.
	12	25	31	29.30	.25	E. SE.	do.		Snow—cloudy.
	13	30	36	.90	.85	SE. SW.	do.		Drizzle—cloudy.
	14	25	23	.75	.75	W.	Blustering.		Cloudy—flurry of snow.
	15	10	29	.75	.55	SW.	Moderate.		Clear day.
⊗	16	16	23	.85	.90	NW.	do.		Snow.
	17	16	21	.90	85	SE.	do.		Clear day.
	18	4	17	30.20	30.26	N.	do.		Snow—lightly cloudy.
	19	9	24	.30	.34	NE. N.	do.		Cloudy day.
	20	25	36	.3	29.96	E.	do.		Lightly cloudy.
	21	32	42	29.84	.84	W.	do.		Clear day.
	22	33	46	.90	.90	W.	do.		Cloudy—hazy.
	23	34	46	.94	.90	NW. SE.	do.		Rainy day.
	24	37	42	.70	.54	SE.	do.		Flying clouds—clear.
☽	25	29	31	.70	.83	W.	Blustering.		Snow.
	26	18	21	.86	.63	NE.	do.		Clear—lightly cloudy.
	2	13	27	30.10	30.20	W.	Moderate.		Clear—lightly cloudy.
	2	17	31	.35	.44	W.	do.		Cloudy day.
	2	18	29	.30	.30	E.	do.		
	Mea	18.45	27.52	29.92	29.90				

	Thermometer.	Barometer.
Maximum height during the month,	46. on 22d and 23d.	30.44 on 28th.
Minimum do. .	0. on 6th.	29.25 on 12th.
Mean do. .	22.93	29.91

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

DEVOTED TO

Mechanical and Physical Science,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1836.

Practical and Theoretical Mechanics.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Suggestions, by Mr. Perkins, in regard to the Explosions of Steam Boilers. By a Correspondent.

There are few subjects of practical science in regard to which the public at large have so deep a stake, as in the determination of the causes of the explosion of steam boilers. And I might add, that there are very few subjects, in relation to which the public require, as yet, more enlightening. Hardly a month passes without some *new boiler* being produced, to be perfectly free from the danger of explosion, and, up to this time, each project has proved an illusion. While the public are thus alternately excited and depressed, practical men neglect even a trial of the various means proposed to render existing boilers more safe, and, without exertion, look on, seeming to consider all devices as alike to be condemned. This state of things is, no doubt, in great part, produced by a want of information in regard to the causes of explosion.

One of the first attempts, on a scale of any magnitude, to remove the existing ignorance on this subject, by experiments, originated with the Franklin Institute; and their committee on the explosions of steam boilers have obviously devoted much time and attention to the researches, which they were enabled by the government to make,* on the dangers to which steam boilers are supposed to be liable.

We have a most interesting fruit from the experiments of this committee, in their immediate application to test a theory of explosions recently advanced by our countryman, Perkins, whose name has been so celebrated in this branch of practical science. The theory to which I refer is an extension and modification of the one formerly advanced by him.

This new theory, or rather the causes which he assigns for the explosions of boilers, and those which he rejects as not producing such an effect, will be found stated in the first number of the Magazine of Popular Science, recently issued in London. The paper purports to be on the subject of a new steam boiler, which is to be free from the danger of explosion.

The ideas of Mr. Perkins will, no doubt, have considerable weight, and, if any of them shall prove erroneous, will, by turning attention away from what *may* be causes of explosion, to what are certainly not, or the reverse, be productive of mischief. The truth or fallacy of most of his suggestions, may be tested by the experiments of the committee before referred to, which, if they had been devised to meet the case, could not have been more direct. I propose, in the following remarks, to point out the bearing of these results.

Mr. Perkins remarks, that, to show why his boiler will be free from explosion, the causes of these accidents must be described. He adds:

"The *first*, and most common cause, is from the pressure of common steam. What is meant by common, or pure steam, is such as has not been suddenly elevated, or such as is not compounded with an explosive mixture, by the improper management of the boiler."

"The first kind of explosion is harmless, as the boiler simply rends, or gives way, in the weakest place, caused from wear, or some defective spot."

That a boiler cannot be exploded by gradual increase of pressure, seems to have been a favourite idea with more than one author, and, indeed, our western engineers have almost made a proverb of it. That the committee, to whose labours I have referred above, entertained a doubt on this head, is obvious from their eighth subject of inquiry, which runs thus.†

VIII. To observe, accurately, the sort of bursting produced by a gradual increase of pressure within cylinders of iron and copper.

They burst one cylinder of iron, and one of copper, by a gradual increase of pressure, and, in both cases, produced a true *explosion*. The cylinders did not simply rend in a weak spot, but "*exploded violently*." The cuts‡ accompanying the statements to which I refer, show how violent this action was. The head of one of the cylinders, the iron one, was thrown to the distance of fifteen feet; the other parts of the boiler, about six feet. Both the heads of the boiler were indented by striking against the iron cylinder in which the fire was made. The copper cylinder was rent in the direction of its length, and singularly doubled and indented by the violence of the explosion. The noise attending its explosion, is described by the committee as "like that from the firing of an eight inch mortar."

---

* See the report of the Committee of the Franklin Institute, &c., Part I., published in this Journal, in January, February, March, April, and May, and in the documents of the Congress of the United States.

† Jour. Frank. Inst., vol. XVII., p. 223.

‡ Ibid., p. 224, and 225.

It is, then, conclusively shown, by these experiments, that Mr. Perkins is in error in his position; an error the more important, that it must bring in its train, inattention to regulating the pressure within a boiler, a belief in the safety of tying down, or overloading, a *safety valve*, and the like. Keep only the supply of water, and never mind the pressure, is the maxim which it inculcates; the worst that can happen, if the boiler gives way, is a simple rent in some weak spot; and, as a deduction, if there are no *weak* spots, the boiler will bear all that can be put upon it. This idea is of most mischievous tendency, and its spreading cannot be too soon checked.

Mr. Perkins next proceeds to the second cause of explosion. "The *second* cause of explosion, which I some years since accidentally discovered and published, and which explanation has since been experimentally proved to be correct, by the celebrated French philosopher, M. Arago, arises from the water getting too low in the boiler. The fire then impinging on that part of the boiler which is above the water, causes the heat to be taken up by the steam, which rises by its superior levity to the top of the boiler, causing it sometimes to become red hot, and so elevating the steam to a much higher temperature than its pressure would indicate. Now when the boiler is in this state, and the safety valve suddenly raised, the water will be relieved from the steam pressure, and rush up amongst the surcharged steam, which thus receives its proper dose of water, at the same time that part of the boiler which has been raised in temperature, giving off its heat to the water so elevated, steam is generated in an instant, of such force as no boiler hitherto made can resist. This kind of explosion has of late years been very frequent and disastrous, particularly in America."

There are so many assertions made in the paragraph just given, that it may be well to recapitulate them.

It is stated as a fact that explosions arise from the water getting too low in a boiler. That the reason why explosion takes place, is that the boiler is heated unduly, producing surcharged steam. That by raising the safety valve, water is thrown into the surcharged steam, and upon the hot metal; receiving heat from both, it is flashed into explosive steam.

That water may get too low in a boiler may readily be granted; then as to the consequences, we have the theory of Mr. Perkins, and the experiments of the committee before referred to. It may seem at first a matter of no great importance whether the hot steam or the hot metal flash the water into steam. It is the hot metal which is the source of the danger. But this will not bear examination, for among other reasons why we should be explicit upon this head, the temperature which may be reached without danger in the two cases, may be very different. Besides, if hot and unsaturated steam collected near the top of a boiler, is absolutely a necessary consequence of unduly heated metal, we may perhaps apply more simple means to determine the existence of danger, than when we are to determine the temperature of the metal of the boiler.

It was first shown by Dulong as a consequence of received laws of heat and vapour, that water thrown into hot and unsaturated steam, would not produce highly elastic steam. Others have repeated the proofs, but still practical men have doubted, probably overlooking the fact that these laws of heat are deductions from experiment, and therefore have all the authority of experiment. But the committee on explosions have made the direct experiment, and it tallies entirely with theory, so called. They raised* steam to 533° of Fahrenheit's thermometer, when if "common steam," it would have had a pressure of more than sixty atmospheres, but not having a full supply of moisture, its pressure was less than seven atmospheres. They injected fourteen ounces of water into this steam, which so far from flashing into highly elastic steam, lowered the pressure to six and a half atmospheres. This is one of many conclusive experiments leading to the same result. Hot and unsaturated steam then cannot *become* dangerously elastic by the projection of water into it.

---

*See Report at page 19, vol. XVII. Journ. Frank. Inst.

If I understand Mr. Perkins aright in his statement respecting M. Arago, he certainly is in error. It is stated in the paper on explosions, by that philosopher, that his experiments referred to an increase of elastic force, within a boiler, accompanying the opening of a safety valve, and that in all the cases which he tried, there was a *decrease*, not an *increase* of pressure attending the opening. He however admits that his experiments were inconclusive, inasmuch as the boilers were not probably unduly heated. He further states that a decisive experiment was made by M. M. Tabareau and Rey on this subject, in which a boiler was unduly heated, and an increased pressure resulted from opening a safety valve. I shall resume this subject, having for the present occupied as much space as you will be disposed to devote to me. I consider the inaccuracy of two of Mr. Perkins's statements as proved by reference to the direct experiments of the Committee of the Franklin Institute.

First. That a gradual increase of pressure within a steam-boiler cannot produce all the most violent effects of explosion.

Second. That the projection of water into hot and unsaturated steam can produce highly elastic, or explosive steam.

Yours, &c.

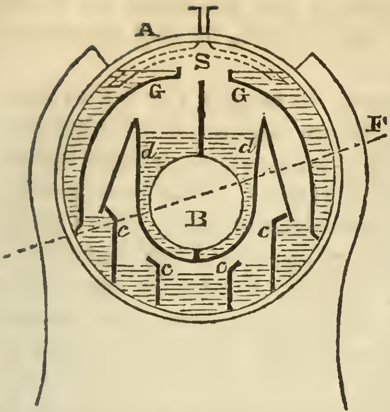
A.

Suggestions of Means calculated to promote Safety in Steam-Boat Boilers.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

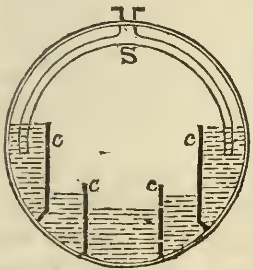
The steam-engine has, no doubt, been retarded in its race of usefulness, and in its applicability to the mechanic arts, by its liability to explosions, accompanied as this accident usually is, by so great a sacrifice of life and property. The existence of so great an evil should induce mechanical and scientific men to seek untiringly for the means of remedying so dangerous a defect. With this view of the importance of any proposed plan of prevention, which may appear feasible, I venture to offer some suggestions on this subject, merely premising that they are given to the public with much diffidence, but still with the hope that they may not be without value.

Many of the explosions of steam-boat boilers that have occurred, especially on the Mississippi, have been attributed to their internal flues, or furnaces, which becoming uncovered with water, by the rolling or continued leaning of the vessel, are rendered red hot, and produce that terrible effect of explosion, which seems to be so generally produced, when iron becomes thus heated, in the presence of water and steam confined. The following is a method proposed for keeping the whole fire-surface safely covered, by a quantity of water, which would be dangerously small, in a common boiler of the same extent of fire surface.



A is an end view of a cylindrical boiler set in a furnace; B is the internal flue passing through from end to end; *c c c c* are upright partitions of thin copper, united water tight to the bottom and ends of the boiler; *d d* represents a semicircular jacket or reservoir, enclosing the flue B, and likewise united water tight to the ends of the boiler; G G are other partitions, forming reservoirs for water against the sides of the boiler. Now the action, it is supposed, will be this: the water passing through the two branches of the supply pipe S, overflows the two reservoirs G G, and falls ver into *d d;* from this it runs down the inclined ledges into the side reservoirs *c c*, and so on to its lowest level. The imaginary line F shows the level which a steam-boat might assume, in a heavy gale, without uncovering any of the fire surface of water. In this position all the cells would be still supplied with water.

This description and drawing is here given, to show the extent to which the principle might be applied, although I am aware, that in practice it might be of doubtful success, except in large boilers, owing to its complicated internal construction, and the difficulty of cleaning when it had become foul from the saline matters of the water. With this view I proceed to describe a more simple arrangement. The figure represents the several metal divisions *c c c c*, and the branches of the supply pipe S.



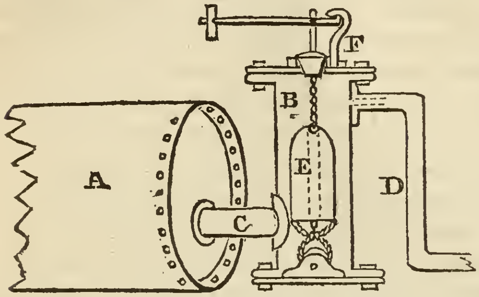
In boilers already in use, I conceive it would add to their safety, to place a single partition up the centre to the heighth of about two-thirds of the diameter, with branches to the supply pipe. It would not, however, furnish the advantages shown in fig. 2, where the same generating surface is obtained from water occupying but little more than half its natural space; and this gain in space adds about one-fourth to the room for the accumulating steam. It might be asked why the placing of a semi-cylinder within the boiler, and a few inches distant from the fire surface,* would not give all the advantages to result from having a thin stratum of water near the generating surface. In such a case, it seems clear, that the generating particles at the bottom of this narrow chamber, would be quite as much pressed by the pressure of the fluid, as though the boiler was occupied by a body of water up to its diameter. The water surface should be as large as the actual fire surface, but in such an arrangement it would be but about one-tenth as large. There could not be a good circulation, and the generation would interfere with its own progress. The principle above described might be employed with advantage in stationary, as well as in steam-boat boilers, and in them the arrangement shown in fig. 1, would become more practicable.

I proceed to a second suggestion of what appears to me to be a durable and efficient apparatus, for lessening the danger of explosion in steam boilers. The inventor freely gives it for the benefit of the mechanical public; holding the opinion that any contrivance which has for its object the prevention of human suffering, death, and sacrifice of property, as a safety apparatus has, should present too strong a claim to the humanity of an inventor, to permit him to retard its general application, by any pecuniary considerations, or exclusive privileges.

---

* As would be shown by the branches of the supply pipe in fig. 2, inverted.

The method about to be described, proposes to supply the boiler with water, during the occasional stoppages of the steam engine, to which times, and to its attending circumstances, the explosion of boilers seem almost invariably to be traced. In the annexed figure, A represents a boiler, B an upright cylinder or reservoir for water; C is a tube entering the boiler just below the common water level, and making a communication between it and reservoir B; D is the induction pipe, through which the engine forces the supply of water for the boiler, into B. The action is supposed to be this: the engine having been stopped, as will frequently happen, and in some cases, regularly, the water in the boiler, evaporates below the orifice of pipe C, the regular supply forced in by the engine, being cut off by its inactivity. Then, as fluids are still governed by the laws of density and gravity, under high pressure, the steam passing through the tube C, will rise to the top of B, permitting water equal in bulk to flow into the boiler, until the orifice of C is covered. It may be necessary that B be lined with wood, that the steam imprisoned may not be too much condensed, or the water will be forced back from the boiler. At the next discharge of water, however, this would be corrected. When the engine is again put in action, the cold water entering at D, condenses the steam in B, and fills it with water. The reservoir B may be made large enough to supply the boiler for one, two or more hours.



The imperfection that presents itself in considering this plan, is this: in case the water becomes all discharged from B, and the engine not set in motion at the end of a limited time, the boiler is as exposed to danger with as without the safety apparatus. To remedy this defect, the float E, and safety valve have been added. F represents the safety valve, with the lever and weight in the usual form, except that the seat or receptacle of the valve is turned with steps, so that the conical valve touches it at two or three points, all of which it has been ground to fit perfectly tight. It is conceived by this means, less liable to become disordered by the rusting of the valve or seat, or the accumulation of matters about them. From the bottom of the safety valve, a brass chain is attached, and descends through a hole made through the float E, and through a pulley, fastened to the bottom of B, and rising up again, it ends in two branches which are made fast to the float.

The float E is supposed to draw on the safety valve, with a buoyancy equal to 20 or 30 pounds, this combined with the pressure of the lever and weight, is equal to the maximum pressure maintained in the boiler. Now when the water is discharged from B, the float pressure of 20 or 30 pounds being taken off, the safety-valve rises, and continues to blow off steam until the engine is again set in motion, and B becomes filled with water. The steam which enters B will not be wasted, though condensed, the water when discharged, carrying the heat back to the boiler again.

New York, April 1, 1836. **R. M.**

Notice of Coal Mines in Illinois. By a CORRESPONDENT.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN—I have received the following information in relation to a locality of coal in Illinois, from Mr. Hall Neilson, of Richmond, Virginia, and consider it of sufficient importance to ask you to place it on the pages of your Journal for permanent reference. The coal alluded to is a dry bituminous coal, of which specimens have been placed in the Cabinet of the Franklin Institute, and of the American Philosophical Society.

The Mount Carbon Coal Mines are on the margin of Big Muddy River, near Brownsville, Jackson County, Illinois, a short distance from its junction with the Mississippi River. The upper stratum of coal which is now opened, and has been worked on a limited scale for many years, is about six or seven feet thick, and lies in a horizontal position above high water mark, leaving room for wharfage between the river and the mines. This coal combines the qualities of the *anthracite* with *pure charcoal*, with a remarkable freedom from sulphur, slate, and other impurities; makes an open fire, ignites very easily, and burns with much flame, and a strong heat, producing little smoke, cinder, or ashes. These rare qualities render this coal of great value and importance in the manufacture of iron and steel, and particularly so, in the production of *steam*. Coal must ere long, be generally adopted for the use of steam-boats, and sugar plantations, on the Mississippi, and for foundries, steam-mills, sugar refineries, cotton presses, and other works at New Orleans; there would, besides, if this coal were in the market, be a large demand for the outward bound shipping from that port, and as ballast for those in the Havana and South American trade, indeed the demand may be considered almost unlimited.

It is understood that the present proprieter of these mines wishes that their working should be undertaken by a company, to form which he has made arrangements.

A CORRESPONDENT.

Table of the Properties, &c., of the Metals, taken from a table by M. Chaudet, of the Paris Mint. By FRANKLIN PEALE, Melter and Refiner of the U. S. Mint.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The following table contains an abstract of the more important and interesting particulars relating to the metals. It is offered for publication under the belief that it will be useful as a matter of reference. The headings of the various columns are believed to be sufficiently explicit to guide the reader. A few of the less important, or more recently discovered, metals, are not inserted; their names are, however, given at the close of the table.

Yours, &c.

FRANKLIN PEALE.

	Names of the metals.	Dates of Discovery.	Names of the Discoverers.	Names of the places where the principal mines are situated.
1	Antimony,	15th cent'y.	Basil Valentine describes the process for extraction.	In France, at Altemont; in Sweden, at Alteberg; in Hungary, in the mines of Cremnitz, and Chemnitz; in Bohemia, in Saxony, in Tuscany, &c.
2	Silver,	Earliest antiquity.		In France, at Altemont, St. Marie aux Mines; Saxony, at Freiberg; in Norway, Spain, Peru, Mexico, Siberia, &c.
3	Arsenic,	1733	Brandt.	In France, at St. Marie aux Mines; Saxony, at Freiberg; Bohemia, England, in the mines of Cornwall, &c.
4	Barium,	1807	Indicated by Davy.	In France, at Royut, (Puy de Dome;) England, "Anglesarcke;" Saxony, near Freiberg; Siberia, Schlangenberg, &c.
5	Bismuth,	1520	Described in the treatise by Agricola.	In France, in Brittany, the Pyrenees; Bohemia, at Gonchienstat; Saxony, at Freiberg; Sweden, Transylvania, near Salatua, &c.
6	Cadmium,	1818	Herman, or Stromeyer.	In Hungary, in the "Bleude Rayonne" of Gazibram.
7	Calcium,	1807	Indicated by Davy.	In France, at Montmartre near Paris, Vizelle near Grenoble; England, in the county of Cumberland; Scotland; Spain, in the province of Estremadura.
8	Cerium,	1804	Hysinger and Berzelius.	In Sweden at Reddarhyta, in the mines of copper of Bastnais; Greenland, &c.
9	Chromium,	1797	Vauquelin.	In Peru, United States, Siberia, &c.
10	Cobalt,	1733	Brandt.	In France, in the Pyrenees, at Altemont; Sweden, at Tauxberg; Saxony, at Amaberg; Bohemia, at Joachienstat; Hesse; Spain, in the valley of Gistan, &c.
11	Columbium or Tantalum,	1802	Hatchet.	In Sweden, America.
12	Copper,	Antiquity.		In France, at St. Bel, near Lyons, Chessy; Spain, Piedmont, England, Germany, Hungary, Sweden, Siberia, North and South America, &c.
13	Tin,	Antiquity.		In Spain, near Montery; England, co. of Cornwall; Bohemia, Saxony, East Indies, Banca, Malacca, &c.
14	Iron,	Antiquity.		In France, at the foot of the Pyrenees; Formoot in Vosge, Normandy, Burgundy; in Germany, Elba, Italy, Siberia, America, &c.

	Names of the substances with which the ore is united in the mines.	State in which they are found	Principal processes of reduction.
1	Sulphur and oxygen.	Native and mineralized.	After purifying the sulphuret, it is roasted with charcoal, "sel du soude," soda, and melted.
2	Antimony, arsenic, sulphur, mercury, oxygen, chlorine.	Native and mineralized.	The sulphuret is roasted with salt, heated with mercury and iron, and the amalgam distilled.
3	Oxygen, sulphur, several metals in the state of arseniates.	Mineralized.	By the calcination of the minerals which contain arsenic, this metal sublimes.
4	Oxygen, sulphuric and carbonic acids.	Mineralized.	By means of the voltaic pile, but obtained in very small quantity.
5	Oxygen, sulphur, and arsenic.	Mineralized.	Mineral bismuth is simply melted, and kept hot some time, to drive away the arsenic.
6	Oxide of zinc.	Mineralized.	The mineral zinc extracted by sulphuric acid, the Cadmium alone is precipitated by hydrochloric acid.
7	Sulphuric, carbonic, fluoric, and phosphoric acids.	Mineralized.	By means of the voltaic pile, but obtained only in very small quantities.
8	Oxygen, silica, and oxide of iron.	Mineralized.	The oxide is mixed with soot and oil, and melted in a strong fire.
9	Oxygen, oxygen and lead, forming the chromate of lead. Oxygen and oxide of iron.	Mineralized.	The oxide is mixed with soot and oil, and melted in a strong fire.
10	Oxygen, arsenic, iron, sulphur, nickel, sulphuric and arsenic acids.	Mineralized.	The oxide is mixed with soot and oil, and melted in a strong fire.
11	Oxygen forming the Colombic acid, oxides of iron, manganese, and itrium.	Mineralized.	By treating the Colombic acid as oxide of Cobalt is treated.
12	Oxygen, sulphur, carbonic, hydrochloric, and sulphuric acids.	Native and mineralized.	The sulphuret is roasted several times, then refined in a reverberatory furnace, the bottom of which is covered with a mixture of charcoal and clay.
13	Oxygen, sulphur.	Mineralized.	The oxide is pounded, washed, roasted, and treated afterwards in a furnace with powdered charcoal.
14	Oxygen, sulphur, carbon, carbonic, hydrochloric, and sulphuric acids.	Native and mineralized.	The oxide is pounded, washed, sometimes roasted, and melted in a high furnace, with fluxes of argil and lime; the cast-iron is afterwards converted into wrought iron.

	Names of the metals.	Colour.	Character.	Specific Gravity.	Degree of fusibility.	Action of heat and air.
1	Antimony,	Blueish white.	Brittle.	6.7021	431° Cent. therm.	Oxidable and volatile.
2	Silver,	Shining white.	Ductile.	10.4753	23° Wed.'s Pyrometer.	Not oxidable.
3	Arsenic,	Grayish white.	Brittle.	5.9590	Undetermin'd	Acidifiable & volatile.
4	Barium,	Undetermined.	Undeter'd.	Undeter'd.	Undetermin'd	Oxidable in the open air.
5	Bismuth,	Grayish white.	Brittle.	9.8220	256° Cent. therm.	Oxidable.
6	Cadmium,	Silvery white, approaching blueish.	Ductile.	8.6040	A little more fusible than zinc.	Oxidable and very volatile.
7	Calcium,	Undetermined.	Pulverulent	Undeter'd.	Undetermin'd	Oxidable in the open air.
8	Cerium,	Grayish white.	Brittle.	Undeter'd.	Infusible at the heat of the furnace.	Oxidable.
9	Chromium,	Grayish white.	Brittle.	Undeter'd.	Almost infusible at the heat of the forge.	Oxidable.
10	Cobalt,	Grayish white of tin.	Brittle.	8.5384	130° Wedg'ds Pyrometer.	Oxidable.
11	Columbium, or Tantalium,	Deep gray.	Pulverulent	Undeter'd.	Infusible at the heat of the forge.	Acidifiable.
12	Copper,	Redish yellow.	Ductile.	8.8950 8.6670	27° Wed's pyrometer.	Oxidable.
13	Tin,	White approaching that of silver.	Ductile.	7.2910	210° Centig'e therm.	Oxidable.
14	Iron,	Gray, with a blueish tint.	Ductile.	7.7880	158° Wed's pyrom.	Oxidable.

	Action of acid with heat.		
	Nitric of 40° Baumé.	Sulphuric of 66°.	Hydrochloric of 22°.
1	Very strong, converted into a white, insoluble oxide.	Feeble.	Very feeble.
2	Strong, solution complete.	Strong, and the solution complete.	No action.
3	Strong, converted into soluble arsenic acid.	Feeble.	Feeble.
4	Violent, solution complete.	Violent, converted into an insoluble sulphate	Violent, solution complete.
5	Strong, solution complete.	Feeble, forming a small quantity of white insoluble oxide.	Very feeble.
6	Strong, solution complete.	Complete solution.	Lively, solution complete.
7	Violent, solution complete.	Violent, converted into a sulphate almost insoluble.	Violent, solution complete.
8	Scarcely perceptible.	No action.	No action.
9	Scarcely perceptible.	Feeble.	No action.
10	Strong, complete solution.	Feeble.	Feeble.
11	Scarcely perceptible.	No action.	No action.
12	Strong, solution complete.	Strong, but the anhydrous sulphate is soluble in water.	Fusible, forming the hydrochlorate, soluble.
13	Very strong, converted into white insoluble oxide.	Feeble.	Very strong, solution complete.
14	Very strong, solution nearly complete, and forming an insoluble oxide.	Feeble; but with weak acid, solution complete.	Very strong, solution complete.

	Names of the metals.	Dates of discovery.	Names of the Discoverers.	Names of the places where the principal mines are situated.
15	Iridium,	1803	Descotels.	Always mixed in the mines with platinum.
16	Lithium,	1818	Arfwedson.	In Sweden, in the Petalite of the mine of Uto.
17	Manganese,	1774	Gahn & Scheele.	In France, at Aveline, (Vosges,) in the Perigueax, and the Romanesche; Saxony, Bohemia, Piedmont, Germany.
18	Mercury,	Antiquity.		In France, in Dauphiny; Spain, at Almaden; Germany, at Idria; Italy; Hungary, near Chemnitz; in America, in Peru, &c.
19	Molybdenum,	1782	Suspected by Scheele, proved by Hielm; also suspected by Bergman.	In France, in the Vosges, at the mine of Tillot, environs of Mont Blanc; Bohemia, in the mines of tin at Schlanckenwald; Saxony, Sweden, Iceland, &c.
20	Nickel,	1751	Cronstedt.	In France, in Allemont; Saxony, at Scheneberg, Armaberg, Freiberg; Bohemia, Joachinstat.
21	Gold,	Antiquity.		In France, in the valley of Doysan; the sands of several rivers on the continent, the Rhone, Garonne, &c.; in Spain, Germany, Hungary, America, North and South, &c.
22	Osmium,	1803	Tennant.	Always mixed with mineral platinum.
23	Palladium,	1803	Wollaston.	Always mixed with the mineral platinum.
24	Platinum,	1741	Wood, Assayer in Jamaica.	At Choco, at Barbacons, St. Domingo, in the bed of the river Yaki, South America, Spain, Russia.
25	Lead,	Antiquity.		In France, in Vienne, (Isere,) Poulhavuen, St. Sauveur, Languedoc, &c.; Germany, in Carinthia; Siberia, at Tarnowitz; in Spain; England, in Derbyshire, &c.
26	Potassium,	1807	Davy.	Wherever there exists lignious plants, particularly at Dantzic, in the Vosges, America, Russia.
27	Rhodium,	1803	Wollaston.	Always mixed with mineral platinum.
28	Sodium,	1807	Davy.	In France, Spain, in the plants which grow on the borders of the Mediterranean; Egypt; Hungary.
29	Strontium,	1807	Indicated by Davy.	In France, near Paris, at Menilmontat, Montmatre, Beauvior, (Mance;) Pennsylvania; Scotland, at Strontian; Peru, near Popayan, &c.

	Names of the substances with which the ore is united in the mines.	State in which they are found	Principal processes of reduction.
15	Osmium, mineral platinum.	Mineralized.	By the humid process.
16	Oxygen, and mixed with petalite and tourmaline.	Mineralized.	By means of the voltaic pile, but in very small quantities.
17	Oxygen, sulphuric, and phosphoric acids.	Mineralized.	The oxide is mixed with soot and oil, and melted in a strong fire.
18	Sulphur, silver, hydrochloric acid.	Native and mineralized.	The sulphuret is mixed with lime, and heated in iron vessels; the mercury is volatilized.
19	Sulphur, oxygen, and lead, forming the molybdate of lead.	Mineralized.	By treating the Molybdic acid as the oxide of Cobalt is treated.
20	Oxygen, arsenic, iron, cobalt, sulphur.	Mineralized.	The oxide is mixed with soot and oil, and melted in a strong fire.
21	Silver, copper, sulphurets of iron and copper.	Native.	Sometimes roasted, and treated with mercury, and distilled.
22	Iridium, mineral platinum.	Mineralized.	By the humid process.
23	Mineral platinum.	Mineralized.	By the humid process.
24	Palladium, rhodium, osmium, iridium.	Mineralized.	It is treated by nitro-muriatic acid, and precipitated by muriate of ammonia, and the precipitate calcined.
25	Oxygen, sulphur, sulphuric, carbonic, phosphoric, hydrochloric, chromic, molybdic, and arsenical acids.	Mineralized.	The sulphuret is pounded, washed, roasted, and melted in a furnace with charcoal.
26	Oxygen, sulphuric, hydrochloric, carbonic, and nitric acids.	Mineralized.	By treating the hydrate of potash at a high temperature with iron.
27	Mineral platinum.	Mineralized.	By the humid process.
28	Oxygen, sulphuric, hydrochloric, and carbonic acids.	Mineralized.	By treating the hydrate of soda, at a high temperature, with iron.
29	Oxygen and acid, in the state of sulphate and carbonate.	Mineralized.	By means of the voltaic pile, but in very small quantity.

	Names of the metals.	Colour.	Character.	Specific Gravity.	Degree of fusibility.	Action of heat and air.
15	Iridium,	Silverish white.	Undeter'd.	18.6800 at least.	Infusible in the heat of the forge.	Not oxidable.
16	Lithium,	Undetermined.	Undeter'd.	Undeter'd.	Undetermin'd	Oxidable in the open air.
17	Manganese,	Grayish white.	Brittle.	6.8500	160 ° Wed'd. pyrom.	Very oxidable
18	Mercury,	White, appr'ing to silver.	Fluid.	13.5680	–39° Cent. th.	Oxidable and volatile.
19	Molybdenum,	Deep gray.	Brittle.	7.4000	Scarcely fusible.	Acidifiable & volatile.
20	Nickel,	Deep gray.	Brittle.	8.2790	160° Wed'd P	Scarcely oxidable.
21	Gold,	Pure yellow.	Ductile.	19.3610 19.2580 See note at end.†	32° Wed'd pyrom.	Not oxidable.
22	Osmium,	Powder black or blueish.	Pulverulent	Undeter'd.	Infusible in the heat of the forge.	Oxidable and volatile.
23	Palladium,	White, appr'ing to silver.	Ductile.	12.0020 11.6270	A little less fusible than iron.	Not oxidable.
24	Platinum,	White, appr'ing to silver.	Ductile.	22.6690 20.9800	Infusible in the heat of forge.	Not oxidable.
25	Lead,	Gray white, approaching blue	Ductile.	11.3520	260° Cent. th.	Oxidable and vitrifiable.
26	Potassium,	Grayish white.	Ductile.	0.86507	58° Cent. th.	Oxidable in the open air.
27	Rhodium,	Grayish white.	Brittle.	appears to be 11.0000	Infusible in the heat of the forge.	Not oxidable.
28	Sodium,	Grayish white.	Ductile.	0.97223	90° Cent. th.	Oxidable in the open air.
29	Strontium,	Undetermined.	Undeter'd.	Undeter'd.	Undetermin'd	Very oxidable

	Action of acid with heat.		
	Nitric of 40°. Baume.	Sulphuric of 60°.	Hydrochloric of 20°.
15	No action.	No action.	No action.
16	Violent, solution complete.	Violent.	Very strong.
17	Slight, solution incomplete.	Feeble, but with a weak acid, complete.	Very strong.
18	Strong, solution complete.	Feeble.	No action.
19	Forming molybdic acid, a grayish insoluble powder.	Feeble.	No action.
20	Strong, complete solution.	No action.	Feeble.
21	No action.	No action.	No action.
22	No action.	No action.	Feeble.
23	Slight, but solution complete.	Very feeble.	No action.
24	No action.	No action.	No action.
25	Strong, complete solution.	Strong, converted into the insoluble sulphate of lead.	Feeble.
26	Violent, solution complete.	Violent, forming an insoluble sulphate.	Violent, solution complete.
27	No action.	No action.	No action.
28	Violent, solution complete.	Violent, forming an insoluble sulphate.	Violent, solution complete.
29	Very strong, solution complete.	Violent, forming an insoluble sulphate.	Violent, solution complete.

	Names of the metals.	Dates of Discovery.	Names of the Discoverers.	Names of the places where the principal mines are found.
30	Tellurium,	1782	Muller.	In Transylvania, at Offenbanger, Fatzbay, in the mines of Maria Lozetto.
31	Titanium,	1781	Gregor.	In France, near Limoges, at Allemont, Hungary, near Boinik; Spain, at Cajuelo; America; England, in Cornwall, &c.
32	Tungsten,	1781	Delhugart.	In France, in the department of Isere and Haute Vienne; Bohemia, at Zinnwald; Saxony, at Ehrenfreidersdorf; Sweden, at Bilverg, &c.
33	Uranium,	1789	Klaproth.	In France, at Simphorien, near Autun, environs of Limoges; Bohemia, at Goachinsthat; Saxony, at Schverberg; England, in Cornwall.
34	Zinc,	1541	Indicated by Paracelsus.	In France, at Vizille, (Ysere,) Bagoory, (haute Pyrenees;) Sweden, at Dammera; England, counties of Somerset and Nottingham; Swabia, Poland, Hungary, &c.

	Names of the substances with which the ore is united in the mines.	State in which they are found	Principal processes of reduction.
30	Iron and gold, gold and silver, gold, silver, and sulphur, lead, sulphur, and copper.	Mineralized.	By the humid process.
31	Oxygen.	Mineralized.	By mixing the oxide with soot and oil, and melting in a strong fire.
32	Oxygen and lime, oxygen and iron, forming the "tungstates."	Mineralized.	By treating the acid of Tungsten as the oxide of Cobalt.
33	Oxygen in the state of protoxide and peroxide.	Mineralized.	By mixing its oxide with soot and oil, and melting in a strong fire.
34	Oxygen, cadmium, sulphur, carbonic and sulphuric acids.	Mineralized.	By treating the Calamium in closed vessels, with charcoal, the zinc sublimes, and is afterwards melted.

---

* There are six others metals, whose existence was first admitted by analogy, or because the matters from which they are extracted have the greatest resemblance to metallic oxides, viz: Magnesium, Glucinium, Lithium, Aluminium, Thorium, and Zirconium. The existence of these metals has been proved, and others discovered, since this table was prepared.

	Names of the metals.	Colour.	Character.	Specific Gravity.	Degree of fusibility.	Action of heat and air.
30	Tellurium,	White, appr'ing to silver.	Brittle.	6.1150	A little less fusible than lead.	Very oxidable
31	Titanium,	Redish brown.	Brittle.	5.3000	Infusible in the heat of the forge.	Oxidable.
32	Tungsten,	Blueish gray.	Brittle.	17.6000 17.5000	Almost infusible.	Oxidable.
33	Uranium,	Deep gray.	Brittle.	9.000	Almost infusible.	Oxidable.
34	Zinc,	Grayish white, approaching to blue.	Ductile.	7.1000 6.8610	370° Cent. th.	Oxidable and volatile.

	Action of acid with heat.		
	Nitric of 40°. Baume.	Hydrochloric of 20°.	Sulphuric of 60°.
30	Strong, solution complete.	Feeble.	No action.
31	Scarcely perceptible.	No action.	Feeble.
32	Scarcely perceptible.	No action.	No action.
33	Strong solution complete.	No action.	No action.
34	Strong solution complete.	Feeble; but with weak acid, the solution complete.	Very strong, solution complete.

---

† Whenever two specific gravities are expressed, the first is that of the metal hammered or condensed, by rolling. Several other metals have been discovered since the date of this table, and several of the compartments marked undetermined, will be found in the last edition of Thenard.

Physical Science.

Second Report of the Joint Committee on Meteorology, of the American Philosophical Society and Franklin Institute.

In commencing this report we have still to regret that the extent of our correspondence north-west and south-east is not great enough to enable us to ascertain the boundaries of our great storms in those directions; and of course we cannot determine the direction of the winds in those boundaries —a knowledge which we believe to be of the highest importance to the science of meteorology. The committee do not yet despair, however, of extending this correspondence so far as to attain so desirable an end, and with the hope of aiding this extension, proceed to give an account of a few of the most remarkable storms which have occured since their first report.

These we are sure will be found to be highly interesting, even with the imperfect knowledge which our limited correspondence enables us to give of them. It will be seen that the character of some of them varies from our great north-east storms which come from the south-west. They seem to have travelled southwardly or south-eastwardly, as will be seen by the storms of the 14th and 15th of May, of the 20th of May and 19th of June.

It is much to be hoped that gentlemen throughout the country, who may see this report, will communicate to us any fact connected with the storms here detailed, which may either be favourable or adverse to the generalization upon which we have ventured.

It would be particularly desirable to know the boundaries of the great rain which took place on the 19th of June, to the north-east. For this purpose, if gentlemen living in Vermont and New Hampshire, and the north of New York, would consult their meteorological journals, and let us know whether it rained there at that time or not, and which way the wind blew, they would confer a great favour on the committee. From the nature of the remarks below, it will be understood what kind of information is wanted. We hope every gentlemen to whom this is sent will be induced to furnish a faithful correspondent, who will at least carefully observe all storms, their beginning and ending, and the course and changes of the wind, during their progress. The labour, though great, of collating numerous journals, and deducing from them general conclusions, will be cheerfully continued by the committee. These journals are carefully preserved in the archives of the Franklin Institute, and will be accessible to any meteorologist who may wish to consult them.

We now proceed to detail the phenomena attending the most remarkable rains and storms which took place between the date of our first report and the eleventh of November, 1835; and to enable the reader to comprehend the report with greater ease, we recommend him to bear in mind this remarkable generalization—*In all the seven storms examined, the wind blew towards the point where it was raining.* To this rule there is not one exception; for though the very first storm mentioned, that of the 26th of April, terminated at Philadelphia, and passed on to the north-east, with the wind still from the north-east, it appears plainly that a much greater storm was raging at that very time at no great distance to the south-west, in the very direction towards which the wind was blowing.

The storm of the 20th of May was evidently too local in its character to form an exception. As it is known, however, that many of our summer storms set in with the wind near the surface of the ground, blowing from the centre of the storm, it becomes a question of high importance to investigate the cause of this difference.

Storm of 26th and 27th of April, 1835.—On the night of the 25th and morning of the 26th of April, at *Philadelphia*, there was a great rain, with the wind at north-east. At the end of the rain the wind continued from the north-east with abated violence, being almost calm on the morning of the 27th, with the lower clouds from the west-north-west, and the upper clouds from the west. At three P. M. the wind was from the east, pretty fresh. At six P. M. a very great rain commenced, which continued through the night, the wind changing round by the north; and at ten the next morning it still rained very hard, with the wind from the north-west, and violent. The rain began to abate at seven, the wind being still violent from the west-north-west, and at eight the rain ceased, with the wind west-north-west, its violence having a little abated. The barometer was now rising rapidly.

At *Cape May*, on the night of the 27th, the wind was violent from the south.

At *Baltimore*,* the rain was very great on the night of the 25th, and continued the most of the day of the 26th. The wind was north-east all day on the 27th. The rain began at three P. M. became very heavy at four, and continued so through the night. On the morning of the 28th, the wind was north-west, and scud and heavy cumuli were rolling off to the south-east. The wind was west in the afternoon.

At *Flushing*, Long Island, New York,† after the rain of April 25th and 26th, the wind continued north-east till half past two o'clock, P. M. of the 27th, when it was south-west. At six it was south, and at seven P. M. it changed suddenly to south-east. The rain commenced at nine P. M. and continued till half past twelve P. M. of the 28th. The wind was very high. In the morning was north-east, and at noon north-west, continuing so all day.

At *Middletown*,‡ Connecticut, after the rain of the 25th and 26th, the wind was variable till some time on the night of the 27th, when the rain commenced, and continued violent. The wind was easterly till eleven, A. M. when it changed to south-east, at noon to south, and at two P. M. to west, the rain continuing with unabated violence all the forenoon. From five P. M. of the 26th till noon of the 27th, the barometer fell more than an inch. The wind westerly in the afternoon.

At *Brown University*,§ Providence, Rhode Island. After the rain of the 25th and 26th, the wind hauled round by the north to north-west, and cleared on the evening of the 26th. On the 27th, the wind came round to the east in the afternoon, and the evening was cloudy. On the 28th, from three to four A. M. there was a heavy blow from the east, with copious rain; at ten A. M. the rain ceased, the clouds beginning to be broken, and the wind violent, hauling southerly. At one P. M. the wind was south-west, very heavy; at four P. M. the wind was westerly, its violence had abated, and the clouds were broken. The barometer began to rise. The weather cleared from nine to ten P. M. the wind having abated; on the next day the wind was westerly.

---

*Our correspondent is Dr. G. Sproston, U. S. Navy.

†Our correspondent at Flushing is Mr. C. Gill.

‡Our correspondent is Mr. A. W. Smith.

§Our correspondent is Professor Caswell.

Storm of 4th and 5th of April, 1835.—*Brown University.* On the 3d of April, 1835, there was a great rain in the night, commencing between eight and nine.

On the 4th, at sun-rise, the wind was north-east, but during the morning it hauled to the north and north-west; towards night swung back to the north-east, and blew heavily during the night. There was a mist, but no rain.

On the 5th, at sun-rise, the wind was heavy from the north-east; there was rain occasionally during the day. From seven to eight o'clock, P. M. the wind came round to the south-west. The clouds had broken away at nine, and the sky was clear at ten.

6th, light shower at nine P. M. wind south-west.

Baltimore,* Maryland. On the 3d, the wind was east, south-east and east. There was a light sprinkling of rain from two to four P. M. The sky was overcast in the evening.

On the 4th, the wind was east in the morning, south-east in the afternoon, with a sprinkling of rain at fifty minutes past ten, A. M. to twelve. The rain recommenced at nine P. M. with lightning, and continued with high wind through the night, turning to sleety snow at twenty-five minutes past nine, A. M. of the 5th, and terminating at fifty minutes past ten, A. M. with the wind east. At twelve the wind changed round to the west, with a heavy reflux of cumuli from the east. At sun-set the wind was south-west, with some rain; starlight at ten P. M.

Philadelphia. On the 3d and 4th, the wind and lower clouds were from the north-east, the upper clouds from the south-west, and middle clouds from south-west, with very hard rain, commencing some time in the night of the 4th, with thunder and hail; continuing on the 5th very hard, with wind east-north-east, violent till half past ten, A. M. The wind changing to east at eleven, blew less violently, and was south-south-east at one P. M. nearly calm; the lower clouds south. The wind was south at half past three P. M. strong from west-south-west at six P. M. strong on the 6th, the wind moderating a little. The rain ceased at noon; very little in the afternoon.

At *Flushing*, Long Island, New York. On the 4th, the wind rose at half past ten P. M. north-east, having been gentle in that direction for two days. It was very high the next morning in the same direction, at a quarter past seven; at quarter past twelve was very high from the east; at half past three brisk from the south-east, and at six high from the south-west. Rain commenced with thunder, at half past eleven, A. M. and with some intermission, ended at two P. M.

At *Baltimore.* On the 4th of May, at half past three P. M. a nimbus rose from the west, against a strong south-east wind; it burst at four, with thunder and lightning, and rained nine-tenths of an inch.

Storm of May 15th, 1835.—*Norfolk*,† Virginia. On the morning of the 15th, there was a great rain, ending at twelve o'clock. At *Philadelphia*, all that morning there was a strong wind and lower clouds from north, and upper clouds from south-south-west, continuing till four P. M. when the clouds disappeared. During the same morning, at *Brown University*, the wind was north-east; with misty rain till twelve.

At *Flushing*, the same morning, the wind was high from the north-east, the lower clouds from the north-east, the middle from the north, and the upper from the west, and at *Cincinnati*,* Ohio, south-west.

---

*Our correspondent is Dr. G. S. Sproston, U. S. Navy.

† From the newspapers.

This rain seemed to have travelled south, for it ceased to rain at Philadelphia on the 14th, at half past twelve; with the wind changing from north-east to north, it continued to rain hard at Baltimore, at three P. M. and only ceased at four. Or as it rained a little on the 15th, at Brown University, till twelve, did it spread outwards in all directions from some centre?

At Portsmouth, sharp lightning south-east, at half past eight P. M.

Storm of the 20*th of May.*—This last appears to be the character of a rain which occurred on the 20th of May, at *Silver Lake*,† Pennsylvania. On this day, at one P. M. a violent thunder storm commenced, with hail, from the west, the day having been clear till that time.

At *Farmington*, Connecticut,‡ a violent storm commenced at four P. M. and lasted till nine.

At *Flushing*, a violent thunder storm began at five, and lasted half an hour, preceded by a squall of wind from the west, the wind having been all day west.

At *Brown University*, a light shower, with thunder and lightning, from six to eight P. M. wind south-westerly all day.

At *Philadelphia*, about seven P. M. a strong wind commenced suddenly from the north-west, it having been pretty strong from the south-south-west all day; at the same time when the wind began to blow from the north-west, the lower clouds were coming from the south-west, and the middle clouds from the north-west; at eight o'clock it began to rain, barometer rising .05 of an inch in an hour. There was some thunder, but not much rain till some time in the night.

At *Baltimore*, it was clear on the 20th at ten P. M. and did not begin to rain till late in the night, and it continued showering the next day till a quarter past nine, P. M.

Storm of July 15*th*, 1835.—At twelve o'clock a violent rain, with hail, commenced at *Baltimore*, with the wind north-east, continuing till seven P. M. The course of the wind in the afternoon not given, but on next day it was west; on the same afternoon and evening there fell tremendous floods at *Woodbury*, New Jersey. At five P. M. when it was raining hard in New Jersey, the wind changed to north at *Philadelphia*, with very dense black clouds coming rapidly from the south, and at six o'clock a most violent rain commenced, lasting till about eleven P. M. with the wind from the north. During all this time there was a most violent gale at *New York*, from the north-east; the rain commencing there at nine P. M. while at *Washington City*, the wind continued all that day and the next, from the south-west, with rain on the 15th, at what hour not mentioned. At *Lancaster*, Pennsylvania, the wind was north, with rain, which is not stated, to have been remarkable. From the phenomena here recorded, it appears that the wind below at New York, Philadelphia and Washington City, was blowing towards a point in New Jersey, for several hours, at the same time when it was raining there most violently. The same was the case at Philadelphia, at least the clouds were coming thick and dark above, from the same point, while the wind below was going to that point.

---

*From the newspapers.

†Our correspondent is Dr. R. H. Rose.

‡Our correspondent is Mr. James Porter Hart.

Storm of November 11*th*, 1835.—The particulars of this remarkable storm will be given hereafter in the Journal of the Franklin Institute; at present we will only say that at *Oswego*, in the south-east corner of Lake Ontario; at the *Ducks*, in the north-east corner; at *Buffalo*, and various other parts in the south-western part of that Lake, the wind, when it was most violent, blew for several hours towards a point in the Lake, near the eastern end, on the morning of the 11th of November, and it changed round by the south, on south side of the Lake, and by north, on north side, to westward.

The north-west corner of this Lake has not yet been heard from. Perhaps some gentleman in *Toronto*, or some place on the north side of the Lake, will have the goodness, on seeing this report, to send us the desired information.

Tornado of June 19*th*, 1835.—On the 19th of June, it rained all day at *Oxford* and *New York*, with the wind south in the morning, south-west in the afternoon.

North of *Albany* there was a very great rain, beginning about eleven, A. M. as we have been informed by Mr. Guynne, who was travelling there that day, and at *Albany* it rained 2.45 inches in the afternoon and evening; wind south in the morning, north in the afternoon.

Brown University. June 19th was clear in the morning, with the wind light from the south-west. The wind freshened towards night; the air very damp, with heavy fog clouds from southerly. Began to rain from eight to nine P. M. with wind very brisk from south-west. Rain 0.4 inches.

Middletown, Connecticut. June 19th, wind south all day; very strong in the evening; rain at noon, and a thunder shower commenced at six P. M. The barometer was lowest on the morning of the 20th; a gale all the next day from the north-west.

Portsmouth, N. H. June 19th, wind south at seven A. M. south-east at two P. M. and east-south-east at sunset On the 20th, gale from half past eight A. M. till half past seven P. M. west by north, with rain from seven P. M. till three A. M. of the 21st; at seven A. M. of the 20th, lower clouds west by south, upper west-north-west; barometer lowest on the morning of the 20th.

At *Mr. Bloomfield's*, 4 miles east from Piscataway, New Jersey. June 19th, about ten P. M. the wind began to blow hard from the south-west, and increased in violence till about two A. M. of the 20th, when it began to abate, and about dawn was nearly calm; during all this time very black clouds, accompanied with terrific lightning, without thunder, almost incessant, were coming exactly against the lower wind from the north-east, or perhaps a little north of that point, with clouds occasionally meeting them, moving with the wind, and the interval between the very black clouds was so bright and silvery, that the stars could hardly be distinguished. About sunrise the north-east wind began to blow, and by eight A. M. had increased to a gale, perfectly clear; continuing violent till about twelve M. when it began to abate, and at two P. M. it had died away. Next day it was strong from the south-west.

19th. On this same day, about five P. M. a violent land-spout took place at New Brunswick and its vicinity. It appeared in form of an inverted cone of smoke, reaching the ground with its apex, and its base among the clouds; it lasted only a few moments in a place, and progressed easterly, a little north, with a slow motion, not more than twenty or thirty miles an hour; it was about two or three hundred yards wide, and within that breadth left neither trees nor houses standing; all the trees were thrown inwards, and generally forwards; many of the houses had their walls prostrated outwards, and the shingles were thrown down in great numbers in Staten Island, along with a shower of hail and rain, from fifteen to twenty-five miles north-east from where they were taken up. During the fall of the hail, on the north side of the vein, the wind was strong from the south, and on the south side of the vein, the wind chopped suddenly round to the north, the wind having been south-west before. At the distance of a few hundred yards from the spout at its passage, the wind was not remarkably strong.

In conclusion, we recommend to our correspondents to observe and note every phenomenon which may tend to establish or refute the generalization to which we turned their attention at the commencement of this report. It is a remarkable fact, and altogether consistent with the generalization here spoken of, that all our great storms which set in from some eastern point, terminate with the wind from some western point; and our correspondents will recollect that all the phenomena detailed in our first report lead to the same conclusion. Among the storms there detailed, not the least remarkable was that on the 22d of March, 1835, in which there was a perfect calm at Philadelphia for several hours, with an extremely low barometer, the sky was very cloudy, without rain, while at the same time there was a most violent rain all round Philadelphia, with very strong wind towards Philadelphia.

Was the air at this moment rising over Philadelphia so rapidly as to carry up the drops of rain and throw them off at the sides of the ascending column? Both the rapid afflux of air towards Philadelphia, at that time, and the extreme depression of the barometer there, lead strongly to an affirmative answer. How extremely interesting would it be if our correspondence were wide enough to trace these storms to their commencement, and follow them to their termination.

And if our present attempt should fail to stimulate men of science to engage in the undertaking of investigating the dynamical laws to which the movements of the atmosphere are subject, and this can only be done by simultaneous observations over a wide extent of territory, then this committee, *unless aided by Government*, will have to leave the work unfinished, and reluctantly close their labours, with perhaps one more report.

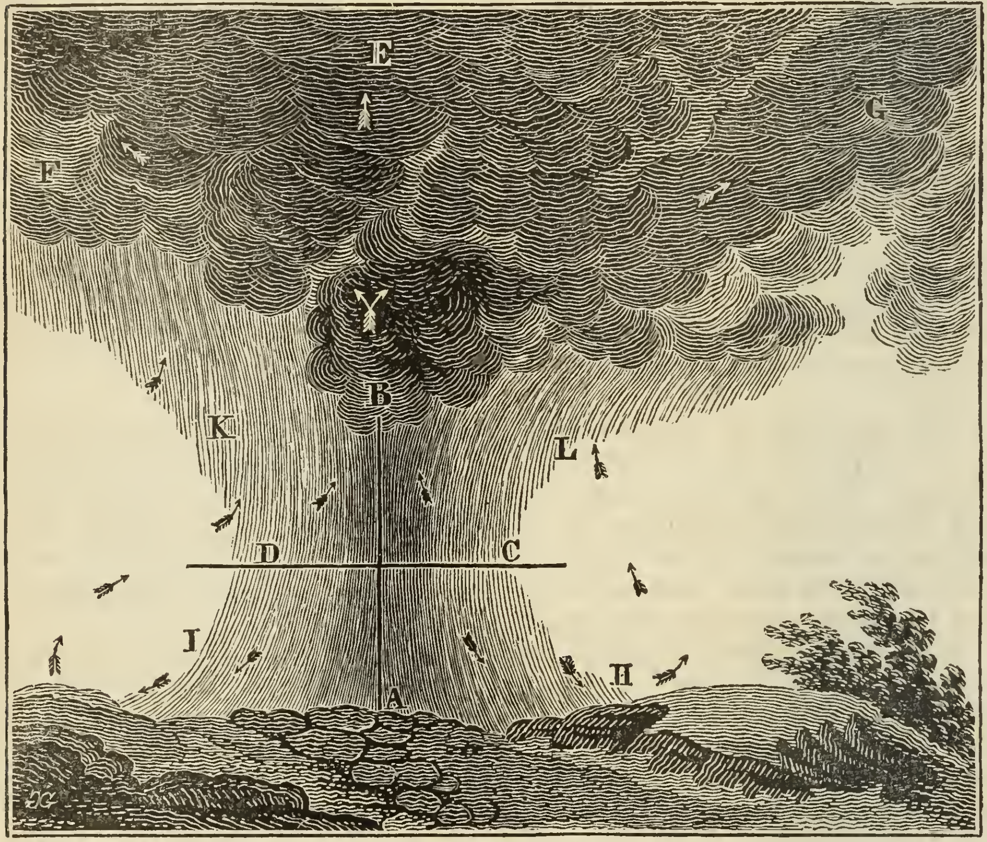
JAMES P. ESPY, Chairman Joint Committee.

Charles N. Bancker, Gouverneur Emerson, Alexander D. Bache,	Com. Amer. Phil. Soc.	James P. Espy, Alex. D. Bache, Henry D. Rogers, S. C. Walker, P. B. Goddard,	Com. Frank. Inst.

Remarks on the foregoing Report, by the Chairman of the Committee.

The sudden change of the wind to the north-west, on the 20th of May, at Philadelphia, in the evening, about three hours after a violent hail storm and rain in the north-west, at Silver Lake, Pennsylvania, may be accounted for by the cooling effects of these depositions on the lower stratum of air, between the cloud and the earth.

If we suppose A, B, in the accompanying wood-cut, the distance of the lower part of a cloud, producing a violent rain, to be one thousand yards, and this whole stratum to be cooled down ten degrees of Fahr., which is a moderate allowance both as to height and temperature, the density would be increased about $\frac{1}{50}$th, and of course it would overbalance, by its superior weight, the columns of air on the outside of the rain, at I and H, and move outwards from the centre of the storm, at the surface of the earth, with a velocity due to a head of pressure of $\frac{3000}{50}$ feet, or $\sqrt{8 \times \frac{3000}{50}} = 62$ feet per second. Whenever a hard shower takes place from a lofty cloud of moderate diameter, such will be the effect at the surface of the earth. For as the perpendicular diameter of a cloud, which produces a very hard rain, must be great, the drops of rain must descend from a great height, and will enter this lower stratum of air very cold, sometimes frozen; the effect will manifestly be as stated above.



This explanation will apply most satisfactorily to the gale which took place at Portsmouth and Middletown, from north-west, and in New Jersey, near Amboy, from the north-east, on the morning of the 20th of June, after a most violent rain, which fell on the evening and night previous, in the eastern part of New York, all round Albany. The wind in all these places blew outwards from where the rain had fallen.

The air in New Jersey was described as piercingly cold, and at Portsmouth, New Hampshire, it was fourteen degrees colder than on the day before at the same hour.

The reader will observe that the clouds below at Philadelphia continued to move from the south-west. on the 20th of May, after the wind changed round to the north-west, while at the same time an upper stratum of clouds was coming from the north-west.

The whole phenomena of this storm, and others of moderate diameter, where the cloud does not descend very low, as it did on the 19th of June, will be clearly comprehended by supposing that there is an inward motion of the air at the lower part of the cloud, an upward motion in the cloud, and an outward motion in the upper part of the cloud, as indicated by the arrows in the wood-cut.

This upward motion also, if it could be shown how it is effected, would account for the condensation of the vapour into rain by the diminution of temperature resulting from diminished pressure, which it is known amounts to at least one degree Fahr., in the case of dry air, for every hundred yards of ascent.

The wood-cut is intended to represent only those storms of moderate size in which the cloud is of sufficient height to let the air below become so cooled as to produce an outward motion at the surface of the earth. There are, however, two other cases in nature, in which the wind at the surface of the earth blows inwards. First, when the cloud reaches down to the surface, or near the surface of the earth, as in the Brunswick spout. Second, when the cloud is of very wide extent, and the rain general; in which case the air to supply the storm with vapour or steam, cannot find room to enter under the cloud without carrying in with it all the air between the cloud and the surface of the earth.

These three kinds embrace all the varieties of storms in nature. Now as the characters of these three kinds of storms are very distinct, and as it will be very convenient hereafter to speak of them separately, I propose to call that kind which is very narrow, and having the wind blowing inwards at the surface of the earth, primary; that one which is of mean size, and has the wind blowing outwards at the surface of the earth, secondary; and that which is very wide, and has the wind blowing inwards at the surface of the earth, tertiary. The choice of these names arises from the theoretic probability that all storms commence with the first character, pass into the second, and terminate with the third. JAMES P. ESPY.

Review of Mitscherlich's Compendium of Chemistry, with remarks on the method of teaching Chemistry. By JAMES C. BOOTH.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Among the votaries of any science, a lively interest is naturally felt in the publication of works connected with that science; a feeling greatly enhanced by the circumstance of their proceeding from men of high reputation. This is more particularly the case with chemistry, which is daily increasing under the hands of its followers, by the accumulation of new and important facts, and by the proposal of new theories to account for the phenomena. Numerous works in this science, of greater or less comparative value, are yearly brought before the tribunal of public opinion, and yet there are but few which do not either wholly fail of success, or which have more than a limited circulation. The cause of this is not so much an ignorance of theory on the part of the author, as the want of sufficient practical knowledge to enable him to put much of his theory to the test. As chemistry is a science of facts, so it cannot be learned without seeing them, nor taught without being able to exhibit them; hence it is that he who has experimented himself, is better able to describe the results of his operations, than he who describes phenomena of which he has only heard or read; for the former gives the more striking impression, which the experiment made on him, the latter the impression as derived from a description. Another cause operates to render the great majority of works in this, as in other sciences, unsuccessful; they are destitute of uniformity of execution. Too few authors, in commencing a work, are themselves aware of their object, or if they be aware of it, pursue it with that uniform and steady aim which is absolutely necessary to its complete success; hence many otherwise excellent treatises are rejected for this reason alone, while others of inferior merit, but exhibiting uniformity of purpose, rise above and even supersede them. "Whoever would please every one, pleases no one," does not lose its force by repetition, for there is no single work on chemistry suited to every class of readers or of students, nor can it indeed be anticipated in a science embracing such an infinite number of facts, and such a variety of objects. What interest does the miner, or the smelter of metals take in organic chemistry? Of how little real utility to the pharmaceutist or manufacturing chemist are discussions relative to the subtle theories of the science? Is it necessary for the purely theoretic chemist to be acquainted with all the details of the manufacturer? How little has the student, when commencing, to do with all these? Lastly, where is the chemist who can embrace them all with the same energy as when devoted to one only? Therefore I contend for unity of purpose, and uniformity of execution, and I think the answers to the foregoing questions will be found conclusive.

A work on chemistry has lately appeared to which the name of its author alone would ensure success, though not perfectly free from the faults I have above endeavoured to point out; for notwithstanding these, it possesses merits of a peculiar kind, entitling it to consideration. Whoever would call over the names of chemists of celebrity, of the present day, and omit in his catalogue that of Professor Mitscherlich, of Berlin, the founder of the doctrine of isomorphism, would do great injustice to him and to the school to which he belongs. For although this doctrine be not fully developed, it has nevertheless been resorted to with success, for correcting former errors, and strengthening certain theories, and promises to become an important agent in disclosing the hidden operations of nature. All that we have hitherto known of Mitscherlich are a few treatises, through the medium of their French translations, and we are now introduced to him as the author of a "Manual of Chemistry." I propose giving a sketch of the subjects contained in the first part of the first volume, (for the whole has not yet appeared) and would wish to draw the attention of the reader at the close, to a few remarks on an important subject, viz. the method of instruction to be pursued, in communicating the facts of chemistry to the uninitiated.

The work commences without preface or introduction, the first page containing an enumeration of the elements with which we are acquainted, and the second thus unceremoniously introducing oxygen to our notice: "If red oxide of mercury be heated in a retort, the neck of which passes through a cork in one opening of a receiver, then, through a tube fitted in another opening, bubbles of air will pass and displace the water contained in an inverted cylinder." This is accompanied by a wood cut representing the apparatus, and a detailed description of the entire operation. A few deductions are then drawn from the experiment, viz: that there is a metallic body liquid at common temperatures; that there is a gaseous body differing in its properties from common air, this being shown by transferring a part of the gas into a smaller vessel, and holding a cinder of wood in it—that these two are held together by a certain power, which is termed affinity, and similar conclusions, such as a reflecting student might be supposed to make for himself. The same experiment is then supposed to be arranged in such a manner, that the resulting metal and gas may be weighed, from which the conclusion is drawn, that the red oxide is composed of certain quantities of the two substances alone, so combined that their individual properties cannot be detected, and in this simple manner the first clear views of the effects of affinity are communicated.

The method of preparing oxygen for practical purposes, from the black oxide of manganese, is next minutely described, together with the iron retort and gas-holder employed in the operation. A large number of experiments are exhibited by Professor Mitscherlich before his class, which are not detailed in the work, his object in doing so being the desire of keeping this first element before the student as long as possible, until the latter shall have fully made its acquaintance by a knowledge of its properties, thus proceeding upon the well established principle, that the mind lays hold of an entirely new subject by slow degrees.

The powers of combination possessed by oxygen are now mentioned, and its compounds with manganese adduced as examples of the union of one body with different proportions of another, as if to break the ground for the reception of the difficult truths relative to combining proportions, and the section is concluded by a numeral representation of the five oxides of manganese, and the three of lead.

The whole is illustrated by eleven wood cuts, representing the apparatus, with the mode of employing it.

I have dwelt more particularly on this first section, that it may serve as a specimen of the remainder, and as I wish to recur to it at the close for the elucidation of a few points, of which I intend to treat.

Hydrogen, and its combination with oxygen, are next introduced, and an experiment arranged to show the composition of water, from which the student obtains an idea of the theory of volumes, and a clearer view of the atomic constitution of bodies.

Nitrogen, and its combinations with oxygen and hydrogen, are mentioned, but not specially treated of, as the former will be found, according to the arrangement adopted by Berzelius, among the acids, the latter with the alkalies.

The peculiar properties of sulphur are now described, and as one of them, its power of crystalizing in certain forms, from which naturally flow observations on the regular forms of bodies. The solid, liquid and vapourous states are exemplified in the body before us, and the section closes with the method of obtaining and purifying it in the large way.

Selenium and phosphorus are slighty noticed, only the combinations of the latter with sulphur and hydrogen being given. Mitscherlich advances the theory that the difference between the two kinds of phosphuretted hydrogen lies merely in a small quantity of phosphorus dissolved by the self-inflammable variety, adducing as an argument the fact that hydrogen in contact with phosphorus for a length of time, takes up a small quantity, causing it to phosphoresce when exposed to the air. According to Rose's analysis, they are chemically the same, and they may be converted into each other by means which we have not as yet wholly in our power. But Mitscherlich's theory does explain how the non-inflammable is sometimes converted into the inflammable variety. It appears to me probable, that the non-inflammable phosphuretted hydrogen is a definite compound, in which the two substances are combined with such force, as not to inflame under common circumstances, but that certain causes operate to decompose it, forming another compound of hydrogen and phosphorus, by which a portion of phosphorus precipitates and is *dissolved* by the new compound, rendering it phosphorescent by the state of minute division of the phosphorus. The union of oxygen in the air with the dissolved phosphorus produces heat, and this in sufficient quantity, inflames the whole. By the reverse action, the dissolved phosphorus is again taken up into chemical union, and forms the non-inflammable variety, and I think that this is the only way in which we can explain the reconversion of one into the other, and their identity as given by analysis.

Chlorine, with its combinations with nitrogen, sulphur, and phosphorus, bromine, iodine and fluorine, follow in succession. An easy method, unattended by danger, of preparing iodide of nitrogen is described, which shows the composition of this class of bodies. A small quantity of nitro-hydrochloric acid is introduced into a test-tube, and a few particles of iodine digested in it at a gentle heat. A part of the oxygen of the nitric combines with hydrogen of the hydro-chloric acid, while the liberated chlorine unites with iodine, forming a brown solution. If ammonia be added to this solution, the chlorine of the chloride of iodine unites with the hydrogen of the ammonia, while the iodide of nitrogen precipitates as a dark brown powder. It is filtered, and the paper, while wet, torn into small pieces and dried.

The diffusive nature of the remarks on phosphuretted hydrogen, while the sulphuretted is passed over in silence, is excused upon the plea, that "the latter belongs more properly to the acids." I think, however, this gas might have been exhibited to keep up in the student's mind the chain necessary to a clear comprehension of the subject.

A too strict adherence to the rule of describing " all the non-acid metalloidal compounds in this place," brings our author into difficulty, for the introduction of many of them is premature, as regards a majority of those for whom the work was intended, that is, for beginners; and accordingly, after describing cyanogen, we have a full account of the combinations of oxygen, hydrogen and carbon, followed by a description of fifteen compounds of hydrogen and carbon, and these again by the combinations of chlorine, bromine and iodine, with the preceding. The author, as if aware of having committed an error, says, "I have considered it proper to mention a large number of compounds in this place, and enough in relation to each of them to excite some degree of interest," and offering as an apology that the " reader will soon discover that a continued examination of these substances is of the highest importance, inasmuch as it may be the means of enriching the science with many interesting facts." But he does not stop here, for after very properly describing the sulphuret of carbon, we are introduced to certain compounds of oxygen, hydrogen, nitrogen and carbon, viz. to the *amids*, which close the long section on carbon. There are eighty-four pages devoted to carbon and its compounds, and only seventy-nine to all previous substances, a circumstance so out of character with the whole tenor of the work, and to the principles which originated it, that we feel ourselves led to inquire into the reason of this deviation. I offer the following very simple solution; first, that this subject, in all its bearings. is at the present moment in the hands of the most distinguished chemists, necessarily giving birth to important facts, which ought to be communicated to the scientific world as soon as possible; and second, that Mitscherlich, with his wonted ability, has himself investigated many of the above compounds, and has deviated from the principles on which the work was commenced, from a desire to make known his discoveries. That this was actually the case, I do not assert, but such are the conclusions to be drawn from a review of the Manual.

A description of borium and silicium closes the first general division of the work, viz. the metalloids and their non-acid mutual combinations.

The remainder of the first part of the first volume is occupied by, first, the general properties of air and the gases, and second, those of water, and collaterally of solid, liquid and aeriform bodies. To gain a just idea of the plan of the whole, it will be necessary to enter a little into detail. The author observes, when introducing the subject, "it appears to me to be more conducive to my end as it certainly would be more intelligible, to bring together in this place what is more general in its nature, and what has been often repeated in the foregoing, after a series of experiments have been instituted, and many phenomena exhibited." I may however observe that the arrangement is not altogether original with Professor Mitscherlich, it being merely a modification of, perhaps an improvement on, the plan adopted by Berzelius in his large work on chemistry. While the former has neither preface nor introduction, the latter precedes his system by a somewhat cursory notice of light, heat and affinity, and a rather long article on electricity and electro-magnetism. Berzelius follows the metalloids by the general properties of gases and liquids, which subject is considerably expanded by Professor Mitscherlich, as will be seen presently.

A description of the air-pump, followed by the mode of determining the specific gravity of gases, naturally leads to an account of the pressure of the air and its measurer, the barometer. Mariotte's law of compression, and that of expansion are properly here introduced, and we are now prepared to determine the composition of the air by means of hydrogen.

The mixture of gases, and the circulation of oxygen precede an important subject, namely, the examination of substances composed of oxygen, hydrogen and carbon.

I propose hereafter to give a translation of the article on the ultimate analysis of organic substances, which, however, I must remark, I think is rather out of place, in the commencement of a work adapted to instruction.

Flame, the distillation of wood and coal, lamps and furnaces, are next minutely described, and close the general properties of air and the gases. A little reflection will, I think, show us that the greater part of the subject is much more intelligible now, than it could have been previous to the exhibition of the metalloids and their compounds, and though perhaps some of the preceding and following articles might have been omitted with propriety, yet I contend for the superiority of the plan in an elementary work, of first introducing substances, and then the laws by which they are governed in their various actions and relations.

The properties of ice, the specific gravity of solids and liquids, and their relations to heat, are succeeded by a subject on which much of the atomic theory depends, viz; the determination of the specific gravity of vapours; in order to ascertain whether the relation between the specific gravity of the solid and its atomic weight is the same as that between the vapour of that body and its atomic constitution. From the experiments of Mitscherlich and of Dumas, it would seem that from the specific gravity of the solid, we cannot draw conclusions as to that of the vapour; hence we cannot say that if a certain weight of carbon unite with a certain weight of sulphur, then so much of the vapour of carbon will unite with so much of the vapour of sulphur. But the difficulties attending such researches are too great to allow us to receive the results with implicit faith, and it is therefore advisable to await the confirming experiments of others in this most important of all subjects connected with the atomic theory.

The pressure of vapours, and by an easy transition, the theory of the steam-engine, are next treated of, and the remainder of the volume is occupied by the general relations of solids to solids, of liquids to liquids, and of these to gases, under which we find capillary attraction; solution, with an interesting table to be seen in Professor Beck's work on chemistry; precipitation; filtration; edulcoration; the antiseptic properties of charcoal; condensation of gases by solids and liquids; many of which subjects are treated of in an original manner by Mitscherlich, and it may be advisable to offer them at some future time, in order not to lengthen this essay too much. I now close the analysis of this first part of Mitscherlich's work, and proceed with the inquiry started at the commencement of these remarks.

A close and careful examination of the section on oxygen brings us to a very important conclusion as to the manner in which the science of chemistry may and ought to be taught. That there is at present a deficiency in regard to our elementary instruction in chemistry, every teacher is well aware, and hence in selecting a work for his classes, he chooses "that which is least exceptionable," thus plainly indicating the difficulty with which he has to contend; but so universally is nearly the same plan adopted, that almost every one arrives sooner or later, at the conclusion that "a student, when commencing, should have some previous knowledge of the subject." Now we are not to suppose our readers totally ignorant of numbers, nor destitute of a general elementary education, but we must suppose them ignorant of the peculiar nature of solids, liquids and gases, that there are invisible bodies around us whose properties render them tangible, that all the bodies seen in nature are composed of a few elements. We ought to suppose that they cannot properly distinguish between the metals, earths, or alkalies, and even that they have no definite idea of what a metal is; and yet, aware of this, how few give a course on chemistry, without preceding it by a long series on heat, light and affinity. In describing the conducting powers of solids, can the student fully understand the subject, when many solids are mentioned, which are quite unknown to him? Can he under like circumstances, fully comprehend the doctrine of the capacity for heat, the pressure of vapours, solution, distillation and the like? What does he know of the bodies quoted to illustrate these general laws, and without which they cannot be understood? Much less is he prepared to encounter the theory of flame, the construction of lamps and furnaces, subjects of great importance to every one, though they are necessarily lost, because the terms used in description, the essential terms have not been defined. But the most unaccountable of all seems to be the development at the commencement of a chemical elementary work, of the laws governing the combinations of bodies both by atoms and volumes. In the tables of elective affinity, what does the student know of sulphuric acid, of baryta, strontia, soda, &c. or of a salt, when he is ignorant of its constituents? He no doubt conceives one body to be pulling others with different degrees of force, but it is next to impossible he should have more definite ideas on the subject than this; and yet a reference to our chemical works will show that these doctrines are introduced, and being theoretic, the reasons for and against the theory are usually brought forward and illustrated by a multitude of examples. Experiments are at the same time instituted by way of proof; but I ask, does not this savour of the mystery of the adepts in alchemy, to exhibit a striking effect, and withhold the cause; for what difference is there between withholding the cause altogether, and explaining it in language known to be unintelligible.

But to proceed farther, can a student master the subtle doctrines of affinity, when those more advanced experience some difficulty in reasoning upon them? For example, the first law of Dalton, that " the composition of bodies is fixed and invariable, must be illustrated by a number of well selected facts. Suppose we take sulphuric acid, which is generally brought forward for this purpose. It is an acid; what notion does the beginner form of an acid? When exhibited to him, he conceives it to be something like an oil, which will corrode animal and vegetable matter. To show its bearing on the above law, he is informed that it is always composed (a novel idea to him) of 16 parts by weight, of sulphur, and 40 of oxygen, and that the sulphuric acid formed by the hand of nature ages ago, and that made artificially at the present day, have precisely the same qualities. With what a multitude of new ideas is he here overwhelmed, that there is an invisible substance, which may be weighed out and made to mingle with a solid, so as to form an acid, in which we cannot detect one of the individual properties of the constituents. It were useless to give more instances, for every one must be struck with the impossibility of rendering a definition intelligible, where the defining terms are not understood, and with the inconsistency of teaching according to this method, while at the same time the instructors must be aware that all their efforts cannot be crowned with success. The remarks made on the first law of combination will apply to the two remaining laws, although the difficulties are increased ten-fold, and I would beg the attention of instructors to this subject; nay, more than this, as our science requires us to "question nature and she will answer us," so I would propose the same principle in this case. Let those interested in the inquiry, experiment for themselves; let them strike out a course founded upon the principle, that "a beginner is wholly unacquainted with the subject," and let them closely observe its effects upon the student, for in this, as well as in other kinds of knowledge, a reflecting and inquiring student often leads us to observations which might otherwise have wholly escaped us, and which may induce important results.

The system adopted by Berzelius, and founded on this principle, was eagerly seized by others, and advantageously extended by Mitscherlich in his Compendium, the commencement of which, the section on oxygen, and a few succeeding, were conceived and executed in a masterly style. He first exhibits an experiment, a fact, and then makes such deductions as naturally flow from it, making the student acquainted with names in connexion with facts. The constant mention of a great number of names, heard for the first time, and without knowing the properties of the substances named, only tends to create a confusion in the mind at the threshold of the science, in the very place where the utmost clearness and precision are requisite. Again, observation teaches us, and it is a received opinion, that we acquire ideas of things before abstract ideas, before we can reason on those things. This is a strong argument in support of my position, but is too generally acknowledged to require amplification.

The whole of Prof. Mitscherlich's Compendium is not conceived with the same energy, and only shows the difficulty of writing with a manifold object in view. For instance, a majority of the compounds described under the article carbon, might have been advantageously deferred to a future portion of the work; there existed no necessity for such diffuse remarks on the general properties of the solids, liquids, and gases, inasmuch as they break in upon the chain of elementary substances, turning the attention from the principal objects to those of minor importance, at least less so in the commencement. The article on organic analysis is wholly misplaced, and only intended for those much farther advanced in the science. The same might be said of many other portions of the work, which inevitably leads us to the conclusion, that it was written for different classes of hearers, and for different purposes. On this point, I refer to my remarks in the introduction to this paper, where I attempted to show, in a concise manner, that a work on chemistry should possess unity and uniformity of plan, object, and execution. Be this as it may, the present volume of Mitscherlich's Compendium is a valuable addition to the chemist's library.

Philadelphia, May, 1836.

Bibliographical Notice.

A Treatise on Astronomy, by Sir John Herschel, &c. &c. A new edition, with a preface, and a series of questions for the examination of students, by S. C. Walker. Philadelphia: Carey, Lea & Blanchard. 1836.

The present edition of this popular work on astronomy is adapted to the use of students in academies, by the addition of a judicious set of questions for examination; a labour of the editor which will be appreciated by teachers. We have been much gratified by a perusal of the preface to this American edition, in which several interesting questions in astronomy are ably discussed. The principal of these are, the extension of the Newtonian law of gravity to the double stars, the correction in the mass hitherto assigned to the planet Jupiter, and the existence of a resisting medium throughout space.

In the first of these, the editor has done that justice to the labours of Sir John Herschel, which the author's characteristic modesty prevented him from doing, and further informs us of the result of some of his astronomical labours at the Cape of Good Hope. Both the other subjects are treated in a like interesting way, and the evidences in favour of the number assigned by the present astronomer royal of England, Mr. Airy, to the mass of Jupiter, are well put forth. The discussion in regard to the resisting medium, as evidenced by the acceleration of the three bodies most liable to its influence, known as Encke's, Biela's, and Halley's comets, leads the editor to the conclusion that "Encke's hypothesis of a resisting medium, is, according to the present state of the science, involved in new perplexities, for it is found, by trial, that no single estimate of the density of this medium, or of the law of its resistance will satisfy the observations of all three of the comets which are most liable to its influences."

The scientific, and even the general, reader, will find this preface to repay him for adding this edition to the former one, should he already possess it. B.

Franklin Institute.

Monthly Conversation Meeting.

The seventh monthly conversation meeting of the Institute, for the season, was held at their Hall, March 24th, 1836.

John Vaughan, Esq., presented samples of sugar obtained from beets, and made some statements respecting the cost of its production in France, and the practicability of introducing the manufacture into the middle sections of the United States.

Prof. W. R. Johnson performed some interesting experiments with an electro-magnetic apparatus.

Mr. George Goodman exhibited a Ruthven printing press, of very neat form.

Mr. Hall Neilson exhibited several specimens of a dry, bituminous coal, from the state of Illinois, remarkable for the readiness with which it ignites.

Franklin Institute Quarterly Meeting.

The forty-ninth quarterly meeting of the Institute was held at their Hall, on Thursday, April 21st, 1836.

Thomas Fletcher, Vice President, presiding;

Isaac P. Morris, Recording Secretary, P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books, maps, and charts, were presented by Messrs. Carey, Lea & Blanchard; Adam Ramage; John C. Trautwine; Charles Roberts; Professor A. D. Bache, and Major Hartman Bache, of Philadelphia.

Donations of minerals, from Mr. John C. Trautwine, and Prof. W. R. Johnson, of Philadelphia, and from Mr. H. Neilson, of Richmond, Va.

John Vaughan, Esq., of Philadelphia, presented a specimen of sugar, made in France, from the beet.

The New York Gold and Silversmiths' Temperance Society presented a copy of their constitution and by-laws, and their certificate of membership.

Constant M. Eakin, Esq., of Philadelphia, presented specimens of zinc, made from the Pennsylvania ore, and of brass, made with the zinc, under the direction of F. R. Hassler, Esq., intended for the fabrication of weights and measures for the United States.

The Actuary laid on the tables, the periodicals received in exchange for the Journal of the Institute, during the past quarter.

The Chairman of the Board of Managers presented the forty-ninth quarterly report of the Board, which was read and accepted, and, on motion, referred for publication.

The Treasurer presented his quarterly report of the finances of the Institute, which was read and accepted.

Extract from the minutes.

Thomas Fletcher, *Vice President.*

Isaac P. Morris, *Rec. Sec. P. T.*

Report of the Board of Managers.

The Board of Managers respectfully submit to the Institute, their orty-ninth quarterly report.

During the past quarter, the courses of instruction have closed, having been attended with their usual success. The want of accommodations, severely felt last year, has, however, tended to diminish the numbers of the class during the present year; a fact which should rouse the members to additional exertions in completing the arrangements for the new hall.

The Professor of Chemistry has evinced his ordinary zeal, and, amid the pressure of manifold professional engagements, has found time to devote to the instruction of his class. His lectures have given great satisfaction.

The Professor of Natural Philosophy has diversified the subjects of his course, even more than usual, during the past year, and his lectures have been well attended.

The Board return thanks to Mr. James C. Booth, for his volunteer lectures on the manufacture of porcelain. It is much to be regretted, that, among so many members of the Institute who are able to contribute to the information of their fellow members, so few are found to volunteer in the cause.

It will be the study of the Committee on Instruction, to endeavour to give more extent to the system of lectures, by supplying the nights vacant from the want of volunteer lectures.

The Drawing Schools have greatly flourished during the past year. The number of pupils in the two departments has been seventy-eight, many of whom have taken tickets for two quarters.

The apathy which has prevailed in regard to the English School, is calculated to discourage both the excellent instructor, who has presided over it, and the managers who have so often urged its claims upon the members.

As of great importance to the future welfare of the Institute, the Board proceed to notice the plan for extending the accommodations. The property of the masonic corporation, in Chesnut street, has been regularly transferred to the Franklin Institute. It has not been deemed prudent, under existing difficulties among mechanics, to go into the erection of a new hall upon this site at the present time. In the meanwhile, the committee who have charge of the property, will use it to the best advantage for the institution. The members should come forward liberally, to the full extent of each one's means and influence, to patronize the attempt to extend the usefulness of the Franklin Institute, by furnishing enlarged accommodations for its lectures, its schools, its library and reading rooms, its cabinets of models and minerals, and its exhibitions.

The contribution to practical science made during the past quarter, in the report of the Committee on the Explosions of Steam-Boilers, has been one of great importance, and may well excite the pride of the members. Public opinion will, it is hoped, be borne along with the final report of this committee, in their recommendations for preventing, or lessening, these disastrous accidents. For that report, the managers look with great interest.

The Committee on Science and the Arts have continued their useful labours in the examination of numerous inventions and improvements submitted to them. Their impartial decisions are, it is believed, highly esteemed by practical men. At their last annual meeting, the committee re-elected Professor A. D. Bache, Chairman for the ensuing year.

The new plan adopted for the Journal of the Institute, has met with considerable success. The same amount of matter on mechanics as formerly, is afforded, and, in addition, original and selected articles on Physical Science are admitted. The Managers again call the attention of the members to the fact, that their patronage of the Journal is by no means what it ought to be. Let no working man plead that he has not time to be a reading man. In the very important part which mechanics have to sustain, they must keep pace with the progress of mechanical science, or they will fall behind in estimation as a class. The Mechanics' Register, attached to the Journal, is not *heavy* reading, and, when more solid articles tire, cannot fail to amuse, as well as to instruct. The Editor, and the Committee on Publications, deserve and receive the thanks of the Board, for their united labours in behalf of the Journal.

The library has increased during the past quarter, by forty-five volumes on useful subjects. The cabinets of models and minerals have received a few additions. When there shall be more room to display their stores, it is hoped and believed that additions to them will be more frequent.

The number of members is increasing steadily. Since the last report, seventeen members have been admitted, and three have resigned. Mr. William Mason, and Mr. Thomas Ryan, have become life members of the Institute.

Herewith is presented the quarterly report of the Treasurer.

M. W. Baldwin, *Chairman.*

William Hamilton, *Actuary.*

Mechanics' Register.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1835.

With Remarks and Exemplifications by the Editor.

1. For improvements in *Manufacturing the Prussiates of Potash and Soda, and in dying therewith, and with certain other materials;* Felix Fossard, city of Philadelphia; an alien, who has resided two years in the United States; November 7.

Mr. Fossard obtained a patent for a purpose similar to the foregoing, on the 14th of December, 1832, and a second on the 3d of April, 1834; and in his present specification he has recapitulated parts of the former for the purpose of making more fully known the improvements which he has since made, which consist, mainly, in the "process of dying blue by the double decomposition of a soluble ferro-cyanate, or prussiate, and a salt of iron, or other metal," by processes which he sets forth, but which are not of a nature to admit of being epitomized, or presented at all in a form which would interest any one not immediately concerned in, and chemically acquainted with, dying processes.

---

2. For a *Machine for Cutting Straw, &c.;* Henry C. Jones, Salem, Warren county, Ohio, November 7.

There is nothing in this cutting machine to distinguish it from a score or two of others, and of this the patentee seems to be aware, as he says that "this machine is operated somewhat similar to other straw cutting machines;" after which he proceeds to claim certain things which are of little or no importance, and some of them, withal, not new.

---

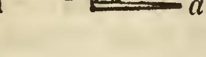
3. For a *Conical Arch Charcoal Burner;* Ezra B. Gilbert, Ephratah, Montgomery county, New York, November 7.

The claim made is to the before described conical arch charcoal burner, for manufacturing charcoal. Excepting in shape, we do not see in what particular this kiln differs from that patented by Mr. Doolittle, in 1829, and described by him in the seventeenth volume of Silliman's Journal, p. 396. We have long had by us a model of a charcoal kiln, exactly in the shape of that now patented. The person who sent it proposed obtaining a patent, but declined doing so when informed that there was not any thing new in the principle of it, or in his mode of application.

---

4. For an improvement in the *Horse Rake;* James Pudney, Stanford, Delaware county, New York, November 7.

Two bars, each about seven feet long, are to have rake teeth fixed into them, at suitable distances apart, and about two feet long. These two bars are to be framed together by timbers at their ends, so that the two bars may be about two and a half, or three, feet apart. The teeth are to point in opposite directions, thus,



where *a a* shows the points of the teeth, *a* and *b*, the timbers by which the two rake heads are framed together. When the rake is drawn forward, one set of points is on the ground, the others serving as handles, by which to guide it. When the rake is full, the upper ones are pushed forward by the person who guides it, and the rake rolls over, depositing the straw, grain, &c. The horse is geared to a frame, allowing of this rolling over, which frame is attached to the rake by headed pins, that pass through a slot in the timbers, *b*, which are double.

The claim is to the manner of using two heads, or rakes, and the self-adjusting slide, or groove, as the ends of the head bars.

5. For a *Machine for Making Crackers;* Levin P. Clark, Baltimore, Maryland, November 7.

So far as we can judge from the description and drawing, this machine must be less efficient than some which have been previously patented and described; although the drawing is generally well executed, we cannot see how some portion of the operations described are to be effected, and cannot, therefore, make them known to others. The combination and arrangement are claimed, as is, *particularly*, a roller for turning the dough on to the moulds, &c.

6. For a *Machine for Cutting Straw;* Ashman Hall, Kent, Putnam county, New York, November 7.

There is to be an angular knife, something like an inverted V, and this forms one of the claims; a claim is made, also, to a board, which is to gauge the length of the straw, and, lastly, to a spring to raise the sliding board; the angular knife is not new, and boards for gauging have been often used in a similar way.

7. For a *Grist Mill;* Phillip Hauser, Cincinnati, Ohio. An alien, who has resided two years in the United States; November 7.

The grinding part of this mill consists of a common conical shell and nut, like those of the ordinary coffee-mill, without a single feature of novelty either in form or substance. The claim is to "the general arrangement and combination, but not to the parts, taken separately." It is one among those gross pretensions at invention which would excite much surprise, were they a little more rare.

8. For a *Rotary Steam Engine;* John G. Hotchkiss, New Haven, New Haven county, Connecticut, November 7.

Abortive attempts at constructing rotary steam engines have been nearly as numerous as the attempts themselves; some of them, however, have evinced a great degree of skill, although unsuccessfully applied; but in the machine which forms the subject of the present patent, we do not perceive much waste of talent, nor any thing likely to disappoint any reasonable expectations. The whole scheme, in fact, is one which evinces an entire absence of elementary knowledge, on the subject of steam in particular, and of mechanics in general.

Steam is to be admitted through a hollow shaft into a revolving metallic drum fixed upon it; this drum has slots, or openings, on its periphery, through which the steam is to escape, and to strike against what are called "buckets," on the inside of a circular rim, by which it is surrounded, and which it nearly touches; the so called buckets are represented as grooves crossing the hollow rim, and formed like saw-teeth. This hollow rim has also slots, or openings, to allow the steam to pass through, and act upon a second rim similarly constructed. Circular heads are to enclose the whole, excepting the last hollow rim, from which the steam may escape at the ends of each bucket.

"The principle of this improvement consists in the combination and arrangement of the steam wheels aforesaid, operating together in alternate opposite directions, by the direct and reacting force of the steam, as aforesaid."

9. For a *Smut Machine;* John Tuck, Columbus, Pennsylvania, November 7.

There is a stationary cylinder of sheet-iron standing on a suitable frame, its axis being inclined at an angle of about ten degrees with the horizon. Within this cylinder there is a second, which is made to revolve, the two being about three-fourths of an inch apart. They are both punched, grater fashion, their rough surfaces being towards each other. Within the inner cylinder there is a revolving fan wheel, extending its whole length. The grain is fed in at the upper end, between the two cylinders; the revolving of the inner one rubs the grain, whilst the wind from the fan, blowing through the apertures, discharges it, together with the cheat and cockle, the openings in the outer cylinder being made large enough for that purpose. The claim is to the machine generally, and "particularly to the shaft and spirally arranged wings for causing a current of air within the revolving drum."

10. For improvements in the *Art of, and Apparatus for, the transportation of Goods upon Canals and Rail-roads;* John Elgar, Civil Engineer, Baltimore, Maryland, November 7. (See specification.)

11. For *Canal Boats, to be propelled by steam;* John Elgar, Civil Engineer, Baltimore, Maryland, November 7.

A twin boat is to be made, the outer sides of each being vertical planes, parallel to each other. If an ordinary keel boat be supposed to be cut through the middle vertically and longitudinally, and the convex sides be then placed opposite to each other, leaving a space between them for a paddle wheel, the proposed form will be understood. It is supposed that such a construction will prevent the washing of canal banks. The claim is to "the straight external sides, with curved internal sides, of a twin steamboat, to be used on canals, and elsewhere."

There have been propositions and patents for similar boats, but we do not know of any now in use, nor do we believe that they will present the anticipated advantage. The water way between the boats becomes less and less as the greatest convexity of the two parts is approached, which causes the water to *pack,* and rise in front, which will occasion, we apprehend, nearly, or quite, as much swell as a boat of the ordinary form, and, at the same time, create a resistance which will consume a part of the power applied.

12. For *Counter Scales;* Elias A. Hibbard, Lunenburg, Essex county, Vermont, November 7.

A beam is made, one end of which is graduated like that of the steelyard, and the other supports a scoop, or scale, into which are put the articles to be weighed. The beam has a cross-bar, forming its fulcrum, and resting upon two uprights; below the scoop, or scale, there are suspending links, with the necessary attachments for the scoop to rest on, and preserve the centre of gravity. The affair is imperfectly described, but the drawing shows the particular construction of the balance, which is certainly inferior to those imported counter scales, which have the weight above the beam, and which are now much used.

13. For *Preparing Extracts of Bark for Tanning;* Otis Batchelder, Bedford, Hillsborough county, North Carolina, November 7.

The following is the recipe: "Put such quantity of the extract of the bark into the vat as may be required; then put upon the extract, vinegar, or some other acid, in the proportion of about two gallons of vinegar to the hundred weight of the extract; after that, put on water, cold or warm, in sufficient quantity to cover the extract; then pulverize and mix well, and then add such quantity of water as may be necessary, and the liquor is fit for use. What he claims as his improvement, is the method of dissolving in cold or warm water, with the addition of acid, instead of boiling, as has been heretofore done."

14. For an improvement in the *Manufacturing of Horse Collars;* Henry C. Call, Sterling, Windham county, Connecticut, November 14.

This collar is, when finished, to be in the form of the most approved collars now in use; "the improvement consists in the process of cutting whole, and making without seam, or welt;" we are told, also, that "the pattern hereunto annexed is for the usual, or common, size;" but the drawing does not represent any such pattern, nor is any attempt at describing it made in the specification.

15. For a *Revolving Screen for Cleaning Grain;* Edward P. Fitzpatrick, Mount Morris, Livingston county, New York. An alien, who has resided two years in the United States; November 14.

Instead of using woven wire, in meshes, as is usually done, this screen is to have wires running straight along it; of these there are to be several sections in the length of the screen, each section extending from one rim to another, which is fastened upon the axle for that purpose. The screen is to be inclined, and the grain fed in at the upper end, in the usual way; the wires in the first section are to be so close together as to allow only dust to pass; the next is to allow cheat to escape; the next small wheat, and the last large wheat. Between the two last it is proposed to form the cylinder of sheet metal, instead of wire, and to punch it full of smooth round holes, large enough for the discharge of cockle.

The claim is to the placing of rods, or wires, lengthwise of the cylinder, from one groove circle to the other, at suitable distances apart, for cleaning grain; instead of woven coverings, with numerous openings.

16. For an *Anti-friction Box for the Hubs of Carriages;* Eyra Fisk and Joseph C. Green, Fayette, Kennebec county, Maine, November 14.

This anti-friction box is a modification of Garnett's friction rollers, of which we have had occasion to make frequent mention, as a similar contrivance has been repeatedly made the subject of a patent. In our notices of these contrivances we have never seen cause to commend them, especially when intended to be applied to carriage wheels, nor do we believe that they have in any instance, been really what they purported to be, improve ments upon Garnett's; and as to the plan now before us, we think it very inferior to the original arrangement.

17. For a *Centrifugal Pneumatic Steam-Engine;* Charles J. Conway, city of New York; an alien, who has resided two years in the United States; November 14.

A very elaborate description of this engine is given, and the advantages expected to be derived from its use are fully set forth, but no claim whatever is made to any part of it; but we are not of opinion that this omission would have any tendency to vitiate the patent, as the general arrangement appears to be new. We are well convinced, however, that this is its only merit, and that we are not likely ever to see it in action, unless some accident should throw us in the way of its first trial, should not that have been already made.

The furnace is to be a revolving tube, surrounded by a case supplied with water for generating steam; this steam, and the gas from the fire are to rush out together tangentially from the periphery of a revolving drum, with a force which is to possess immense power. The fuel is to be supplied through the hollow axle on which the machine revolves, and is to be thrown into the furnace by centrifugal force. The averments of the specification contravene the known laws of mechanical and of chemical philosophy in more than one instance.

18. For *Cisterns, Reservoirs, &c. of Hydraulic Cement;* Levi Kidder, city of New York, November 14.

A pit is to be dug, of a circular form, and the bottom of it is to be covered with hydraulic cement, say to the depth of six inches; upon this floor is to be laid a cylindrical mould, allowing sufficient space between it and the earth for the thickness of the intended side wall, which space is to be filled in with hydraulic cement; another cylindrical section is then to be placed on the former, and the process repeated until the wall is of the required height. To counteract the external pressure from water in the soil, the cistern may be supplied with water from any convenient source, as the work proceeds. The claim is to the foregoing process; a claim which can be as well sustained as most of those previously set forth in patents for making cisterns of hydraulic cement; but no better.

19. For *Anodyne Alterative Syrup;* Rezin Thompson, Rome, Smith county, Tennessee, November 14.

Take 2 oz. extract of henbane,
14 oz. extract of walnut, or butternut,
2 oz. essence of sassafras, and
1 gal. simple sirop.

Dose for an adult, half a table spoonful, &c.

20. For *Raising Vessels from the Water for the purpose of Repair;* Rufus Porter, Bellerica, Middlesex county, Massachusetts, November 14. (See specification.)

21. For an improvement in the *Smut Machine;* Edward B. Fitzpatrick, Mount Morris, Livingston county, New York, November 14.

This smut machine is to consist of an outer stationary cylinder, standing vertically, its periphery being formed of longitudinal rods or wires, placed so close together that grain will not pass between them, whilst the dust from the smut will escape readily. Within this there are to be revolving beaters formed by extending square iron rods from one set of cross arms on the lower end of a revolving shaft, within the cylinder, to other similar cross bars near the upper end of the shaft, and close within the heads of the cylinder; these rods are to be made ragged at their edges, and placed near together on the cross arms, extending from the shaft to the periphery of the cylinder. They are not to run directly along with the cylinder, but spirally, just as they would stand supposing them to be put in straight at first, and one of the sets of cross arms to be then turned half way round, thus giving a spiral direction to the rods.

The grain is to be fed in through the upper head of the cylinder, and to escape through an opening in the bottom head; but in passing down it is driven forcibly about by encountering the spiral beaters, the shaft of which revolves with great rapidity, and by this means, it is said, the smut is effectually removed.

The claim is to the above described manner of constructing a smut machine.

22. For *Preparing and Using Elastic Japan for Leather;* William Gates, Hanover, Chatauque county, New York, November 14.

The japan is to be prepared by boiling two quarts of linseed oil until the yellow scum disappears, then adding two ounces of umber, and one of litharge, and boiling again for an hour and a half; after this the dryers are to be allowed to settle, and the clear liquor poured off. Eight ounces of India rubber, in shreds, are to be heated in a vessel with two quarts of spirits of turpentine; to these are to be added the two quarts of boiled oil and the compound is to be kept at a boiling heat until the gum is completely dissolved, which may be six hours. Eight ounces of asphaltum are then to be added and dissolved. This constitutes the japan.

The second part of the process consists in laying the varnish on the leather, which is to be done by a brush or sponge, and in the rubbing down and slicking, which are minutely described. The claims made are to "the particular method of compounding the japan so as to make it elastic, and at the same time permit it to dry readily; and the manner of affixing it to the leather."

We do not see any thing in the manner of compounding the japan, which is new to us, either as respects the materials employed, or the mode of treating them; nor is the manipulation of laying it on, rubbing it down, slicking, &c. generally distinguished from the plans heretofore followed.

23. For a *Fire-place and Cooking Stove;* Joshua Douglass, Durham, Cumberland county, Maine, November 14.

This stove does not require description, as we could not possibly distinguish it from numerous others; the claims are to the "fire-place and jointed damper, as combined with the cooking stove, in the manner described."

24. For a *Truss of Gum Elastic,* for Inguinal Hernia; Varnum Wilkinson, city of New York, November 14.

The distinguishing feature of this truss is said to be the formation of it without the employment of metal or of wood, in any part of it; the pad also being different in shape from others. The patentee says that he had used India rubber before Dr. Heintzelman obtained his patent for a pad of that material, but we could point to trusses where not only the pad, but the strap also was of India rubber, made some years prior to Heintzelman's patent, which latter was not for the material employed, but for the particular manner of using it. The present patentee has left his description so vague and general as to be very far indeed from fulfilling the requirements of the patent law.

25. For a *Machine for Extracting Hair from Skins;* Nahum Swett, Readfield, Kennebec county, Maine, November 14.

The skin is to be placed upon a revolving cylinder, to which it is to be attached, by means described in the specification, but very inadequately represented in the drawing. An elastic roller, covered with India rubber, which is again covered with leather, is borne up by spiral springs against the revolving cylinder, and the hair is to be taken off by means of a knife, fixed for that purpose. The claims made are to the particular manner of constructing the cylinder, and of fastening the skin thereto; the mode of constructing the elastic roller, and the general arrangement of the several parts.

26. For a *Truss for Hernia;* Robert Semple, Concordia Parish, State of Louisiana, November 14.

The general construction of this truss is that most commonly employed, the improvement claimed being in "the construction and material of the front pad;" which is to be formed of wood, and to be covered with thin sheet lead, or a composition of lead and zinc. This, it is said, makes a block, or pad, so light as to be easily retained in its place, whilst the polished surface of the metal prevents the abrasion of the skin.

Hard substances have been so long used for pads to trusses, that a claim to them simply, would be unavailing. One with a pad of solid lead has been the subject of a patent. Ivory has been used for at least forty years, and is as smooth and light as one of wood covered with metal; we really, therefore, cannot perceive any ground upon which the present claim is to be sustained.

27. For *Propelling Boats by a Spiral Screw;* Edward P. Fitzpatrick, Mount Morris, Livingston county, New York, November 23.

The shaft of this screw is to swell in the middle, so as to resemble two cones united at their bases, and the spiral thread by which it is surrounded is also to be wider at the middle than at the ends; the so making this screw constitutes the whole claim. The spiral screw propeller has been so often patented, tried and condemned; that its history, if written, would be one of disappointed hopes, which might well serve as a beacon to future voyagers. We do not believe that it can ever be made to assume a form by which it will be rendered efficient, and most certainly that given to it by the present patentee will not, in the slightest degree, redeem its character.

28. For a *Cheese Press;* William C. Greenleaf, Andover, Oxford county, Maine, November 23.

A follower is to be forced down by a toggle joint, the pressure being continued by hanging a weight to a lever, or arm, attached to the joint. The patentee says, "I do not claim the original invention of the toggle joint, but I do claim as my invention its application to the purpose of pressing cheese." Independently of the toggle joint having been previously used for the purpose, such a claim we esteem as altogether worthless, for if a claim to the "application" is valid, there may be as many patents for one press as there are articles to be pressed. The law grants patents for any "new machine."

---

29. For a *Spark Catcher;* George Holbrook, Boston, Massachusetts, November 23.

We do not perceive any essential difference between this spark catcher and some others which have been previously patented. The sparks are to be arrested by coverings of wire gauze, and are to fall into a tubular reservoir surrounding the chimney. The arrangement of the coverings is somewhat different from that of others, but not to an extent which changes its character. The claim made is to "the manner of constructing and applying the frames as set forth."

---

30. For a *Machine for Dressing Feathers;* Bartholomew Smith, Schodack, Rensellaer county, New York, November 23.

A tub of sheet iron is to be made, which may be six or eight feet in diameter, and its bottom is to be perforated with numerous small holes. A vertical shaft, which is to be made to revolve by means of a wheel, rises from the centre of the tub, and carries a number of curved whippers, or beaters, which are to act upon the feathers. A covering of sheet iron, or of any other suitable material, say of cotton ticking, is to rise above the tub, and to surround the beaters and feathers. Under the middle of the tub there is to be a small furnace for heating the feathers, the heat being confined, and reflected under the tub by a tin vessel, or casing. It does not appear that water or steam are to be in any way employed in the process. There is not any claim made, and the only difference which we see between this machine and others is in shape; to some of them it is certainly inferior, being less convenient, and neglecting an agent, steam, which is very advantageously employed in dressing feathers.

---

31. For *Administering Medicine by Steam;* Benjamin Grut, city of New York, November 23.

Steam is to be conducted through certain herbs placed upon a strainer in a tin vessel, the vapour being led to the place desired through a tube in the top of the vessel.

"It is the method of disengaging and applying the medicinal virtues of plants, herbs, and roots, to a local part of the body, for which I claim a patent as my own invention, and not previously known."

---

32. For a *Bedstead and Mattress combined;* Edmund Cherrington, Boston, Massachusetts, November 23.

Instead of the sacking bottom usually employed, tubes of metal, with worm springs and steel plates, are to support the mattress. The posts and rails are to be put together by dove-tail fastenings, which, if they differ from those formerly used, are not clearly explained. The claims made are to "the steel plates attached to the worm springs in the metal tubes, and the manner of applying the same; and the manner of putting the bedstead and mattress together, and fastening them with a dove-tail and button." The manner of applying the steel springs, &c. is the same as in the next article, to which, therefore, we refer.

---

33. For a *Spring to be used in Sofas, Chairs, &c.* Edmund Cherrington, Boston, Massachusetts, November 23.

We insert the whole description. "Two worm springs are enclosed in brass, or other metal, tubes; a steel plate of the length required, is attached to the hooks on the ends of the worm springs, and extends from the one to the other."

"What I claim as my invention, and not previously known, is attaching the steel spring as aforesaid, and applying it to the purposes above described."

Spiral steel springs are to be enclosed in tubes, like those of spiral spring weighing machines, and rows of these are to be placed along each side of the frame of the sofa seat, (or bedstead;) to these are hooked thin metal straps extending from side to side, like strained girths, and upon them the mattress. in the former patent, and the sofa seat in the present, are to rest.

---

34. For improvements in the *Constructing of Rail Roads;* Elisha Johnson, Civil Engineer, Rochester, Monroe county, New York, November 23.

The patentee of the improvements which are described is, it appears, the Chief Engineer of the Towanda Rail Road, commencing at the city of Rochester, in the state of New York. The object proposed is to save a very large portion of the labour and cost in filling up when there are to be embankments. The whole description, with the accompanying observations occupy considerable space, and all that we can do, at present, is to give a general idea of the mode of procedure.

In passing through a well timbered district, where embankments are to be made, a road is constructed by fixing vertical blocks, or posts, of rough timber, squared at the ends; these may be 18 inches in diameter, and be placed ten feet apart, lengthwise of the road; upon them are to be placed round cross timbers, 12 feet in diameter and 9 in length; these, of course, being spotted to fit on to the uprights. Longitudinal pieces of round timber, not less than a foot in diameter, are to be hewn flat at top, and squared at the ends, in lengths of ten feet. Hard string pieces, 2 by 4 inches, are to be spiked on to the longitudinal pieces, and upon them the cars are to run. "The framed earth boxes are of a new and particular form, adapted to the purpose of completing the excavation and embankments; they are to have four, six, or eight wheels. Those with eight wheels have four earth boxes, one at each end, to dump endwise, and two in the middle, to dump at the sides.

The embankments are to be made by filling in along this temporary rail road, and it is to be continued in use until there has been a perfect settling of the earth, serving during this period, all the purposes of transportation; after which the permanent rails are to be laid in the usual manner.

The claims made are to the application of such rough timber as is at hand, in the way described. The use thereof for the purpose of embanking, and for transportation during the settling of the earth. The extending of the road into and through swamps and prairies; and the covering the whole of the timber with earth, excepting the ribbons on which the iron plates are spiked.

A large part of the specification is devoted to a display of the advantages which are to result from the mode of procedure adopted; the means, however, by which results are attained, are the only things patentable. How much of the plan proposed is to be considered as new, is left to the judgment of those informed in the history of the construction of rail roads; we will remark, however, that we do not find any thing set forth in that clear and discriminating manner which is requisite to secure it under a patent.

35. For *Machinery for Making Horse Shoes;* Henry Burden, Troy, Rensselaer county, New York, November 23.

The specification of this patent refers to three sheets of drawing, representing the machinery very clearly; it must be manifest, therefore, that we cannot here attempt a description of it in words. The machine is evidently constructed by one possessing much skill and knowledge in mechanics; and all the accounts we have heard of its performance, concur in representing it as effecting the intended purpose in a very perfect manner.

36. For a *Spring Saddle;* Adam Hickman, Abington, Washington county, Virginia, November 23.

The claim made is to a "spring, which is attached to the hind plating of the tree, thence running to the under part of the cantle, and working on brass or steel plates, fastened to the under part of the cantle;" "which spring gives the cantle and steel bars an action similar to the operation of a bellows, the saddle itself being drawn over the steel bars."

37. For a *Marine Hoisting Apparatus;* John C. Campbell, and Increase S. Withington, Boston, Massachusetts, November 26.

This apparatus, we are informed, is intended to raise sunken vessels; to float stranded vessels off shore; to carry vessels over shoals; and to raise them out of the water for repair.

"These objects are effected by sinking hollow boats, or casks, filled with water, and attached to the object to be raised, and then expelling the water by a forcing pump from the boats, or casks, and supplying its place with air."

The manner in which this may be done is described, presenting nothing new in principle, or in practice, but exhibiting the application of a mode of raising vessels which has been more frequently resorted to than any other, and that from time immemorial. The patentees, however, limit themselves to the particular construction of the apparatus described, their claim being to "the machine, or apparatus, herein described, as combined together for the purposes before mentioned."

38. For an improvement in *Steam Boilers;* Thomas Ashcroft, Machinist, Boston, Massachusetts. An alien, who has resided two years in the United States; November 26.

This is a complex apparatus, consisting of a main vertical cylindrical boiler, surrounded by six, or any other convenient number of small boilers, each of which is to have its separate furnace. The main boiler may be a cylinder of thirteen feet in height, and two in diameter, closed at top, and at bottom. A casing round this boiler, and distant from it about three or four inches, extends up to the top of the main boiler, and is open for the escape of smoke, &c. Another case surrounds this, and is called the *steam* *passage;* this is closed both at bottom and top, but communicates, by means of tubes, with the main boiler.

The six surrounding boilers are to be upright, and about three feet in height, their bottoms being about even with that of the main boiler; they consist of water compartments, surrounding the furnace, and receive their supply from the main boiler exclusively. The steam from each of them passes, through tubes, into the steam passage, and then into the main boiler.

The claim is to "the combination of boilers and apparatus before described, by which one main boiler of greater height, and less exposed to the heat, is enabled to supply water to one or more smaller boilers, which are more exposed to the heat, for the purpose of keeping them constantly full by the pressure of the column of water in the main boiler."

We cannot concur with the patentee in the idea that such a boiler can be made at less cost than one of the ordinary construction; great difficulty must be encountered in it, from the incrustation which will take place within the smaller boilers, but the anticipated circulation of the water will, it is calculated, prevent this, an effect to which we do not believe that it will be equal.

---

39. For *Chilling the Interior Surfaces of Cast-iron Cylinders;* Henry Saunders, Dobb's Ferry, West Chester county, New York, November 7.

Conical boxes have been chilled on their inner surfaces by casting them upon solid metal cores, which are driven out whilst the iron is yet hot; but cylindrical metal cores cannot be thus removed. The present patent is taken for so constructing cylindrical metal cores, that they can be readily removed, leaving the cast cylinders smooth, true, and hard, on the interior.

To effect this object, the cores are to be divided, longitudinally, into two, three, or more, pieces, and these are to be kept together by collars passing over projections on their ends, for that purpose; conical wedges, or pins, are used to keep the pieces properly extended, by driving them into openings in the ends of the core. Those persons who have noticed the manner in which hat blocks are divided, to remove them from hats with enlarged crowns, will at once understand the principle adopted in the present case. The claim is to "all iron castings, of whatever form, size, or kind, having cylindrical interior faces, and which shall be chilled upon iron, or other metallic pins, composed of two or more parts, and divided longitudinally."

---

40. For a *Mortising Machine;* John M'Bride, Richmond, Wayne county, Indiana, November 26.

In this machine, the chisel is made to advance upon the piece to be mortised, instead of causing the piece to move under the chisel. The chisel is to be acted upon by two compound levers, one of which is to be moved up and down by the hand. The fulcrum of the lever to which the chisel is attached, is on a kind of slide, which is caused to progress forward by a pall falling into a rack. The precise way in which this is effected is not clearly shown, and, indeed, there is considerable obscurity in the description of the machine in general, so that a workman could not undertake to make it from the information furnished. The claims would not serve to convey any definite idea of the things which are the subjects of them.

41. For *Turnabouts, or Platforms, for turning rail-road cars;* David Evans, Penn township, Philadelphia county, Pennsylvania, November 26.

This platform is to have conical rollers, by which it is to be sustained; arms extending from the centre, under the platform, upon which they are to revolve; and there is also to be a safety lever for arresting the platform, when it has arrived in the proper position.

The claims are to "the *conical balls*, with holes, or axles, and the guidance of them by the main centre, by means of the bars extending therefrom to the hoop on the outer circumference; and the self-tending safety lever, for regulating, or stopping, this, or any other, platform."

---

42. For a *Sheet-iron Boat for Navigating Canals;* Leeman Parmelee, Poughkeepsie, Dutchess county, New York, November 26.

This patent is taken for making a twin boat of sheet-iron, as will be seen by the claim to invention, which "consists in the *sheet-iron twin boat*, for navigating canals by steam, or horse, power." There is not any thing peculiar in the formation of the boats, nor is there any thing new in making canal boats of sheet-iron; the invention consists, therefore, in putting two such boats together, exactly in the way in which twin boats of wood have been united.

---

43. For a *Spring Saddle;* Charles Bates, Staunton, Augusta county, Virginia, November 26.

The spring of this saddle is exactly similar to such as have been made the subjects of two or three recent patents, from the same State, the principal change being the employment of two zig-zag springs, instead of one, and the fixing them somewhat differently in the iron frame within which they act.

The patentee says, "I do not claim the form of the zig-zag spring and frame; but what I do claim as my invention, is the peculiar mode of arranging and securing *two* springs to the movable bar, as above described."

---

44. For an improvement on *Tub Water Wheels;* Edward Newnam, Hendricks county, Indiana, November 26.

This is a poor contrivance, poorly described, and as poorly represented. The design, however, appears to be to double the power of the water, by letting it on at opposite sides of the wheel. The affair is without a claim, and is not worth one.

---

45. For an improvement in the construction of *Crucibles, Stove Cylinders, Grate Backs, &c.;* John Scott, city of Philadelphia, November 26.

This improvement consists "*in the use and application* of the inconsumable substance, *asbestus*, in the construction of crucibles," &c., "as follows. Let the asbestus be mixed with mineral substances, pulverized and moistened so as to form a thick clay, such as isinglass, soap-stone, black lead, and fire clay; and then let the mass be hardened by the action of heat, or by gradual drying."

The whole of the foregoing proceeds under the mistaken notion that asbestus had not been before used as a component part of the linings of furnaces, and the formation of other articles which are to bear high degrees of heat. We have used, and seen it used, for such purposes, in numerous instances, and there is no experimental or operative chemist to whom the use of this material would be a novelty, and who would not have employed it, when at hand, without claiming to have made any discovery. "In Corsica it is advantageously used in the manufacture of pottery, being reduced to fine filaments, and kneaded up with the clay; the effect of which is to render the vessels less liable to break, from sudden alternations of heat and cold, than common pottery." Article, ASBESTUS, Encyclopedia Americana. This is the first authority to which we turned, but numerous others might readily be cited.

---

46. For *Sheet-iron Fire Frames;* Gilbert Richards, Ashfield, Franklin county, Massachusetts, November 26.

The whole *invention* consists in making the sides, top, and front plate, of a Franklin stove, of sheet, instead of cast-iron, and the so doing constitutes the claim.

---

47. For *Hulling and Cleaning Cotton, and other, Seeds;* John Ambler, Jr., city of Philadelphia, November 26. (See specification.)

---

48. For an improvement in the *Hydrant;* Sater F. Walker, city of Baltimore, November 26.

The claim under this patent is to "the mode described of constructing and using the ascending tube, so as to discharge the waste water at pleasure, either above or below the surface of the ground; the mode of preserving the distance between the valve seat and screwed nut at the top; and the making a waste cock of metal with a wooden key, and leather interposed." It would require considerable space to explain the arrangements referred to, and as we understand that Mr. Walker is about to apply for a new patent for certain modifications of his apparatus, we shall wait until these come under our notice.

---

49. For an improvement in *Grist Mills;* Samuel Hyde, Malone, Franklin county, New York, November 30.

This appears to be intended for a portable mill, although no dimensions are given. Both stones are to revolve in the same direction, the lower with a slow, the upper with a rapid motion. The lower stone is fixed upon a hollow shaft, and the upper upon a spindle which passes through it. The shaft of the lower stone runs upon "bead rollers," that is, upon round balls retained in a groove. The gearing we shall not attempt to describe, as this might be varied by any competent workman. The running both stones in the same direction, with different velocities, is claimed, and, for aught we know, this claim may be sustained; but we are uninformed respecting, and cannot perceive, any advantage which can result from this construction, whilst it is open to the objection of complexity. The "bead rollers," at the bottom of the exterior shaft, are claimed, but they have repeatedly been applied to shafts, although soon abandoned, as they are theoretically and practically bad.

---

50. For an instrument for *Cutting Wood;* John Ruthven, city of New York. An alien, who has declared his intention to become a citizen; November 30.

This instrument is to be used as a substitute for mill, cross-cut, circular, and other saws. The cutting part consists of two steel edges, which are to operate like a paring chisel, taking off a narrow shaving, instead of tearing the wood by numerous points. A mortise is to be made on the edge of a blade, such a blade, for example, as would be fixed in a frame, in the place of a mill saw; and into this the cutters are to be secured, one edge pointed in either direction, so that the cutting may be effected both by the up and down strokes, the feed of the log, in this case, taking place at the termination of each stroke. In the circular saw, the cutters will, of course, all stand in the same direction, and the feed, we suppose, will be continuous.

When used for cross cutting, there are to be additional lateral cutters, to cut across the grain, like the fore iron in a cut-and-thrust, or a plane for cutting grooves across boards.

The claim made is to "the instruments described, and the method of cutting wood by them."

We very much doubt the general applicability of this method of cutting wood, instead of sawing it; a good mill saw may be fed half an inch at each stroke, whilst cutters, such as those described, cannot be allowed to cut more than an eighth of an inch, making a quarter in the double stroke. There will be a difficulty, also, in holding down the log in the up stroke, and the stuff will *spole* when the cutters arrive at the edges of the boards. The kerf, also, we apprehend, must be made thicker than with a good saw. The cross cutting appears to present other objections, which, with those already enumerated, we shall be glad to hear have been practically dissipated.

---

51. For a *Spark Catcher*; James W. Waples, Wilmington, New Castle county, Delaware, November 30.

This spark catcher is to turn, like a vane, at the top of the chimney, a shaft passing up from the centre to sustain, and allow it to revolve. The part immediately over the chimney is covered with wire gauze, forming a segment of a hollow globe, but the whole is extended out on one side, so that the bottom of the spark catcher may be in the form of a long oval, the extended part being called the receiver; the covering of wire gauze is common to the whole, but that part in front, or rather to windward, is coarser than usual, to admit air the more freely, the other end, or receiver, acting as a vane, and keeping the whole in the proper direction. The two parts are united by a hinge at top, allowing the receiver to be turned up, to discharge the sparks, ashes, &c., when they have accumulated.

The claim is to "the before described spark catcher and receiver, and the mode of cleaning the receiver."

---

52. For a *Reel to receive Water-proof Cloth as it is coated with the composition;* John Goulding and Reuben Brackett, Boston, Massachusetts, November 30.

The reel is to receive the cloth after it passes the reservoir by which one of its surfaces is covered with the composition, and is so constructed that the successive portions are kept from contact with those which preceded it. It consists of an axis, turning on gudgeons, and having at each end, within the uprights, six or any other preferred number of arms, standing at right angles thereto. These arms are notched on their edges, at regular distances, to receive the ends of rods, or cross bars, extending from one to the other. The end of the cloth being properly secured, near the axle, the rods, as the reel is turned, are successively put into their places, and the sides of the cloth are thus kept separate, the whole forming a sort of hexagonal spiral.

The claim is to "winding cloth covered with dissolved India rubber, or water-proof composition, on a reel, at the time of coating, or after the operation of coating has been completed."

The circular tenter bars, described at page 19, vol. XVI, are an analogous contrivance, but not adapted by the arrangement of its parts, to the purpose to which the present reel is applied.

53. For a *Diving Dress;* John Read Campbell, Boston, Massachusetts, November 30.

This is said to be an improvement on the diving suit patented by Nathaniel Wolcott, on the 17th of April, 1834, which has been assigned to the present patentee. One notice of that patent may be seen at page 330, vol. XIV. The improvements proposed are the making the cap, or case, for the head, entirely of glass, to increase the field of vision, and the encircling the body by a metallic case, under the India rubber cloth, to prevent compression. The philosophy of some of the appendages described, we do not comprehend, nor can we discover that any of the ordinary difficulties in the use of such dresses are more completely obviated than by previous contrivances.

54. For a *Kiln for Drying Grain;* Thomas Crook, New Hope, Bucks county, Pennsylvania, November 30.

This patent is taken for an improvement upon a kiln for the same purpose, patented by Benjamin Parry, in the year 1810. In this kiln, it appears that the grain was fed into an inclined pan, contained in a chamber heated by a furnace and flues, the pan being agitated by a roller to cause the grain to descend regularly along it. The present patentee uses two pans, one above the other, and inclined in reverse directions, the grain falling from the first into the second; he suspends his pans by chains, and agitates them by a roller in a more convenient manner than heretofore. The claims made are to "the manner of arranging a second pan under the first, for the purpose described. The manner of strengthening the pans, as above, and the method of supporting them at the outside, by swing chains, instead of a roller."

55. For a *Hot Air Forge Hearth;* Richard Walker and Leonidas V. Badger, Portsmouth, Rockingham county, New Hampshire, November 30.

A box is to be made which consists of two parts, standing at right angles to each other; one of these constitutes the back, and the other the bottom of the forge. Each of the parts may be a foot square, and two and a half, or three inches deep. The air is blown in in the usual way, and traverses back and forth several times, between partitions, before it arrives at the tuyere. The claim is to "passing the wind under and back of the fire, making a complete hot air blast." At least one-half of this claim is invalid, as the air has already been heated by a similar box at the backs of forges, if not under them.

56. For a Machine for *Cutting Straw;* John Wirt, Evansham, Wythe county, Virginia, November 30.

The whole of this apparatus is confessedly old, with the exception of "a cog wheel on the shaft of the cutting and fly wheel, working in the teeth of the crown wheel, on the end of the lower feeding roller, for feeding the machine." The same purpose has been effected by similar means, and that forty years since.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for Improvements in the Art of, and Apparatus for, the Transportation of Goods upon Canals and Rail Roads. Granted to JOHN ELGAR, *Civil Engineer, Baltimore, Maryland, November 7th,* 1835.

To all whom it may concern, be it known, that I, John Elgar, of the city of Baltimore, in the state of Maryland, have invented certain improvements in the art of, and in the apparatus for, the conveyance or transportation of goods, on a line where canals and rail roads form alternate links in the chain of communication, as for example, on the great Pennsylvania line from Philadelphia to Pittsburg; a part of which invention, or improvement, may be applied to the construction of, and transportation in canal boats, on those lines in which the mode of conveyance is by water alone; and I do hereby declare that the following is a full and exact description of my said improvement, or invention.

The object which I have in view in the first instance, is to prevent the necessity of removing the goods from the vehicle within which they are first loaded, by constructing cases which serve on rail roads as car bodies, and on canals as boats. This I effect by making such vehicles, or car bodies, of sheet iron, in the manner of iron tanks, riveting them up water-tight in the same way. The dimensions of these bodies must be determined by that of the canal locks, through which they are to pass when used as boats. If, for example, the lock will admit a boat of fourteen feet in width, and eighty in length, the bodies may be made seven feet wide and twenty feet long, so that eight bodies, two abreast, and four in length, may pass at the same time. I intend sometimes to make the bodies wholly of sheet iron, but they may be made of that material to the height of about three feet only, with an additional height, say of three feet, made of wood. The bodies when made of this length are to be carried upon eight-wheeled cars. If four-wheeled cars are preferred, the bodies must be made of a length suitable thereto, and a greater number of them will then, of course, be connected together, when in the water.

As these bodies are, by their combination, to form canal boats, the requisite number of them are to be so formed at one end as to constitute a well shaped bow, and the same number are to be so shaped as to constitute a stern; the other ends are to be made square, so that when connected by proper fastenings they will be in one continuous inflexible line, to the length of the lock through which they are to pass.

It is a well known fact that the resistance to a boat moving through the water, is nearly as the cross section of the part immersed, without regard to length; and I contemplate the obtaining a great advantage from the application of this principle in the conversion of my car bodies into canal boats, as they are to be made but half the width of an ordinary boat, their draught being the same, their cross section will be but one half; I contemplate, therefore, the coupling of these bodies together in one continuous line, without placing them side by side, excepting when they are passing through locks, by which means but one half the power of traction ordinarily required will be found necessary, the foremost and the hindmost bodies constituting a stem and stern.

The great length given to the combined boat in this case, will render it necessary to make provision for passing along those parts of the canal where there is any considerable curvature. For this purpose I construct a certain number of the bodies in such a manner as that when coupled so as to constitute a canal boat, they will form a rule joint, which will allow of the requisite lateral motion to conform them to the curvature of the canal. To make such a joint, the end of one of the bodies composing it must terminate in the concave arc of a semicircle, and that of the corresponding one in a convex semicircle, adapted to each other. The distance apart of these flexible joints should be equal to that of an ordinary canal boat, so that when detached they will pass side by side through the locks.

These rule joint sections are to be coupled together by a connecting bar which falls, or is placed, on a strong upright pin, fixed in the centre of the circumference of the joint, or in any other convenient mode.

To cause the boats so connected to conform to the curvature of the canal, and to steer them by making one act as a rudder to the other, I fix a wheel and pinion, or adapt a lever, or other power, at each rule joint, so as to communicate the requisite degree of flexure. A compound boat of any desired length may thus be formed and managed, the first of the series of sections, only, being bow formed, and the last, only, stern-formed.

The bodies may be transferred from the cars to the water, and from the water to the cars, by means of powerful cranes; but the mode which I intend in general to adopt, is to extend the rail way down into the canal basin, in the manner practised in marine rail ways; the bodies may thus be made to float from, and on to the cars, with the utmost facility.

The rule joint, and mode of steering, I also intend to apply to canal boats of the ordinary construction and length, but reduced in breadth one half, so that in passing through locks the boats may be disconnected at the joints, and pass through in pairs, side by side, thus obtaining the advantage before alluded to as resulting from the diminution of the cross section, and admitting of an increased velocity with a decreased injury to the banks of the canal.

What I claim as my invention in the within described art of, and apparatus for the conveyance or transportation of goods on lines of canal and rail road, is the constructing of car bodies in the manner set forth, so that they may be converted into canal boats, upon the principle, and for the purposes herein fully described and specified. I also claim the connecting of such, or other canal boats, by rule joints, for the purpose of adapting them to the curvature of the canal, and of steering them by their action upon each other, upon the same principle with that by which a rudder is made to steer an ordinary boat.

JOHN ELGAR.

Specification of a Patent for an Apparatus, and Mode of Using the same, for Raising Vessels for the purpose of Repair. Granted to Rufus Porter, *Bellerica, Middlesex county, Massachusetts, November* 14*th*, 1835.

Four square timbers, eighty feet in length, are placed parallel to each other, and so arranged that the space between each pair is ten feet, and the whole breadth across the four is forty-feet. Across these are placed, at equal distances, seventeen other timbers, forty feet long, being firmly secured to the first four by tree-nails, and over these last is placed a strong plank floor; the whole constituting a stage, or platform, eighty feet in length, and forty in breadth. This platform rests on four square trunks, each being thirty feet long, ten feet wide, and ten feet deep. These trunks are constructed of framed timbers and plank, and are closed and made water tight on all-sides, except an open space of ten feet in length, by four in breadth, in the centre of the bottom of each, and are placed under the four corners of the platform, between the long timbers above mentioned, so that only the cross timbers rest on the tops of the trunks. The platform is further supported by braces extending diagonally from the sides to the trunks, and also connected by iron rods crossing from one to the other. The platform and trunks, which thus connected I call the elevator, being put into the water, or rather having been constructed afloat, a sufficient quantity of stone is placed on the iron rods to cause the whole to sink when filled with water.

Two scows, each eighty feet long, and eight feet wide, are kept in attendance, one of which floats over each side of the elevator; and ropes being attached to the four corners of the elevator, or to arms projecting therefrom, are also made fast to the bow and stern of each scow, thus preventing the elevator from sinking below a certain depth, say twelve feet below the surface of the water. Each scow contains, besides a small steam engine, of one horse power, two hollow cylinders similar to the cylindrical boilers of high pressure engines, each cylinder being thirty feet long, and thirty inches in diameter. From each of the four cylinders a piece of leather hose extends to one of the four trunks, being firmly attached to each. These cylinders being charged, by the power of the steam engines, with fifteen atmospheres of compressed air, the vessel to be raised is floated between the scows, or if the vessel lays at anchor, the scows may be propelled by the steam power, to a station on each side of the vessel, dragging the elevator with them, which is then raised by the ropes until the middle of the floor comes in contact with the keel of the vessel, and is secured in that position by several ropes or chains, which being attached to the sides of the elevator, are made fast to the timber heads of the vessel. Moreover, several chucks, or blocks, previously prepared and connected with the elevator, are placed under the bottom of the vessel to support the same in its position when raised. Then, by means of valves, the compressed air in the cylinders is permitted to escape through the hose into the interior of the trunks, which immediately gives them a buoyancy of about seven hundred thousand pounds. But if the vessel thus raised be of such a size as not to require so much power of buoyancy, the compressed air may be instantly shut off, whenever the floor of the elevator shall have risen fairly above the surface of the water.

While one vessel is being repaired, the cylinders are again charged; and when the repairs of one are completed, other valves are opened, which permit the air to escape from the trunks, while the vessel settles readily, but gently, into the water, and the elevator is ready to receive another; thus avoiding the ordinary delay attendant on raising vessels by the usual method.

I claim the construction and mode of using the elevator generally.

RUFUS PORTER.

Remarks by the Editor.—We have been induced to publish the foregoing specification entire, because it describes the thing patented with a directness and clearness which may serve as an example to others. There is nothing extraneous about it, and we could scarcely, therefore, have done any thing like justice to it had we epitomized it in the ordinary monthly list. There is nothing new in the principle of raising vessels by means of air forced into hollow trunks, but the whole arrangement set forth gives a distinct and special character to the plan before us, by which it can undoubtedly be sustained.

Specification of a Patent for a Machine for Hulling Cotton and other Seeds. Granted to JOHN AMBLER, JR. *City of Philadelphia, November 26th,* 1835.

To all whom it may concern, be it known, that I, John Ambler, Jr. of the city of Philadelphia, in the State of Pennsylvania, have invented an improved machine for hulling and cleaning cotton and other seed, which I denominate the Metallic Cotton Seed Huller, and that the following is a full and exact description thereof.

Upon an iron shaft, revolving horizontally, I place two, or any other convenient number of steel or iron disks, or circular plates of metal, so as to run with perfect truth upon the shafts; disks of eighteen inches in diameter, I have found to answer the purpose perfectly well. By means of a pointed chisel I raise teeth, in the manner of rasp teeth, on each side of these revolving disks, or I groove, or roughen them in any other manner calculated to produce the intended effect. The disks, as they revolve, pass through the flat bottom of a hopper, by which they are surmounted, projecting above the said bottom about one third of their diameter. Steel plates, cut like the disks, are placed on each side of them; the upper edges of these plates are on a level with the bottom of the hopper, and they extend down to the lower part of the revolving disks, covering about one-fourth part of the face thereof, this having been found sufficient to effect the hulling, perfectly. These lateral plates are attached to adjustable sliding bars, or fixed in any other way which will admit of their distance from the disks being regulated according to the kind of seed to be hulled. It has been found best not to increase the opening between the plates and disks at the upper edge, but to preserve their parallelism throughout, so that but one seed can find its way between them at a time.

The seeds and hulls fall upon a sloping skreen, or riddle, which is made to shake, and to carry the portion which does not pass through the riddle to a revolving picker, placed at one end of the frame; this picker, and the hollow segment within which it revolves, are set with teeth in the manner of a picker for wool, and serve to separate the matted portion of the hulls, cotton, and seed, so that the lighter portion may be driven off by a revolving fan placed at the lower part of the machine for the purpose of cleaning the hulled seed.

The riddles, screens, shakers, fan, &c. which I employ, do not differ from such as are in common use for cleaning grain and other seed, and do not, therefore, require to be particularly described, as they make no part of my invention, and may be variously modified, or used separately from the hulling apparatus.

What I claim as my invention, and wish to secure by letters patent, is the hulling of cotton, and other seed, by means of revolving disks, or plates of steel, or other metal, made and operating substantially in the manner hereinbefore set forth.

John Ambler, Jr.

Progress of Theoretical and Practical Mechanics and Chemistry.

Economy of Steam Power.

As this subject has latterly begun to attract the general attention it so well deserves, it is evidently of much importance that the nature of the recent improvements in question should be well understood, in order that their practicability, or rather *expediency*, under different local circumstances, should be properly appreciated.

Some persons appear to consider that the expansive working of high pressure steam, constitutes the *only* improvement by which the expenditure of fuel is so greatly economised in the Cornish engines. It is, therefore, very natural to state that considerable power is lost in obtaining this advantage. To a certain and limited extent this may be true, but the improvements in question consist, in great measure, of *other arrangements*, against which no such objection can be urged, and from which, therefore, unmixed benefit is derived, as I shall presently endeavor to show.

Although the expansive working of high pressure steam in the manner introduced by Mr. Woolf, is undoubtedly a very important feature in the Cornish steam engines, in their present improved state, their superior excellence and economy, is by no means to be attributed to *this source only*, as several other causes greatly contribute towards it. These causes are the following:—1st, An improved construction of boilers, by which the generation of steam is more rapidly and more perfectly effected. 2nd, in allowing a short interval between each stroke, by which means the condensation of the steam is perfectly accomplished. 3rd, (perhaps the most important feature,) the prevention, to a very great extent, of the usual escape of heat from those parts of the engine through which the steam passes, by the application of a *proper casing composed of substances known to be very imperfect conductors of caloric.* In this casing the boiler, steam pipes, and cylinder, are, of course, carefully enveloped. 4th, The great care and attention used in working the engines; all parties concerned being stimulated to exertion by the admirable system of publishing regular monthly returns of the duty, &c. of all the engines working in the county.

On the 3rd of these causes, or the application of casing, I lay much stress, both on account of its actual importance, and also of the ease and small expense with which it may in all cases be applied to engines, although not originally constructed with this intention. It appears, indeed, from experiment, that by this simple alteration (or rather addition) only, that the duty of an engine may be nearly doubled, or, in other words, *its expenditure of fuel reduced one-half, without any diminution of its power*, a fact well deserving the attention of those who are concerned in the use of steam engines, whether in places where coal is expensive or not.

It is sometimes supposed that the engines now used in Cornwall, are constructed with two cylinders, in the manner introduced by Woolf—no engines of this kind have been employed there, however, for many years; all of those now working in the county being impelled by steam acting expansively in a *single cylinder*, as first proposed by Watt, although of course of great elasticity, in accordance with Woolf's great and acknowledged improvement.

It is doubted how far it would be prudent to adopt these improvements in the neighborhood of Glasgow, where coal is abundant. As the application of them of course involves some degree of expense, this is strictly *a matter of calculation*, and not of opinion; but, when the expenditure of fuel can be reduced one-half, (which I am convinced in many cases might be done,) by the simple application of casings in the manner before noticed, and without any loss of power, there is, I think, good reason for supposing that *this improvement*, *at least*, would be desirable in all situations, however cheap fuel may be. The waste of coal, arising from the unchecked radiation of heat in the engines used in our coal mine districts, must be enormous, nor can any thing be conceived more barbarous (unless, indeed, the *mere destruction of coal* be one of the objects in view) than the construction of the engines in the mines of Staffordshire, and other coal districts. The boilers are generally made of a somewhat spherical form, much resembling those employed in the earlier atmospheric engines, and, together with the steam pipes, stand detached from the engine house, and quite exposed to the air, having no roof or covering whatever. It is evident that an immense escape of heat must take place from these enormous surfaces, exposed as they are to all atmospheric changes. I have never ascertained the temperature of the outside of these boilers by a thermometer; the surface is, however, too hot to be approached by the hand, and as the exterior can only differ from the interior by refrigeration (certainly, under these circumstances, a rapid process) we may, perhaps, conclude, from the known conducting power of the metals, that it may even approach 200 degrees.

The following memoranda, made some time ago in Cornwall, will show how differently things are managed there.

United Mines, Little engine—a 30 inch cylinder—

Temperature	of external atmosphere . . .	67 deg. Fah.
Ditto	of engine-room	68 deg. Fah.
Ditto	of boiler-house	70 deg. Fah.

Cardozo's Engine—a 90 inch cylinder—

Temperature	of external atmosphere, as before.	
Ditto	of engine-room	71 deg. Fah.
Ditto	of boiler-house	75 deg. Fah

Consolidated Mines, Job's Engine—a 90 inch cylinder—

Temperature	of external atmosphere as before.	
Ditto	of engine-room	70 deg. Fah.
Ditto	of boiler-house	72 deg. Fah.

These observations were made quite at random, nor were the best engines in the mines selected for that purpose, as there were others of superior construction and doing better duty. They will serve, however, to show the extraordinary success with which casing is applied by the Cornish engineers, an improvement perhaps of greater general interest than any other, from its extreme simplicity, and the ease with which it may be applied in all cases where economy of fuel is desirable. FREDERICK BURR.

London Mining Journal.

Instances of Spontaneous Combustion, detailed in a paper read before the Royal Irish Academy, 25th May, 1835. By M. SCANLAN, ESQ.

In the beginning of last March, a fire broke out in the extensive turpentine distillery on Sir John Rogerson's quay, belonging to Mr. John Fish Murphy, which is separated from my chemical factory by Windmill Lane. The fire, which was speedily got under, was confined to a heap of what is termed, by turpentine distillers, chip cake, and from the circumstances under which it occurred, could not be attributed to any other cause than the act of an incendiary, or to the spontaneous ignition of this chip cake.

As spontaneous combustion of this substance has never occurred before in Murphy's distillery, nor in that of his father, an extensive distiller of turpentine for many years, at Stratford in Essex, I at first doubted that the fire could have originated in this way; however, on inquiry, I found his mode of working had been, on this particular occasion, different from that usually employed in his distillery, and, experiments which he kindly permitted me to make, have since proved beyond doubt that combustion did take place spontaneously.

Raw turpentine, as it comes from America, in barrels, includes a considerable quantity of impurity, consisting of chips of wood, leaves, and leaf stalks.* It was the practice in Mr. Murphy's distillery, as it is in England, to heat the raw turpentine up to a temperature of about 180°, as I found by plunging the thermometer into one of his large copper pans, and to strain the turpentine, thus liquified, from the impurities, previously to introducing it into the still, where it is submitted to distillation in the usual way, with a portion of water, yielding turpentine oil, which distils over along with the water, and rosin which remains behind in the still. The chips when separated by a wire strainer, still retain a quantity of adhering turpentine worth saving, and with this view are transferred to a large close vat, where they are exposed for some time to the action of steam furnished by a boiler kept for this purpose, as well as for steaming the empty barrels, in order to remove any turpentine that may adhere to them. Still, however, the chips are a good deal imbued with resinous matter, and in this state form a loose porous mass, which the turpentine distiller calls chip cake, a material which is used by the poor in the neighborhood as fuel.

As long as the process I have just described was pursued, which is the London mode, and that which produces the best rosin, no accident occurred from fire in Mr. Murphy's premises, although I have frequently seen immense heaps of this chip cake collected together in his yard; but, on making trial of a different plan, namely, that practised by a Dublin distiller, Mr. Price of Lincoln Lane, the accident in question occurred.

---

* The following extract from the letter of a French turpentine merchant, will account for the presence of these foreign bodies. To obtain the turpentine "the fir timber is chopped about a man's height down its side with an axe, not hand deep, and afterwards higher up. The turpentine or *rosin* is scraped up from the foot of the tree. That which is on the side wound, when scraped off, is white, and is called *galley pot*, of which the burning incense is made. It does not yield so much turpentine spirit as the pat."—*Ed. of Records of Science.*

On this occasion the raw turpentine, together with its impurities, was put directly into the still, along with the proper quantity of water, and the boiling rosin at the end of the operation strained from the chips.

The chip cake resulting from a single operation thus conducted, was laid in a heap outside the still house at 3 o'clock in the afternoon, and at midnight was discovered to be in flames.

In the first mentioned process, it is obvious the chips were never exposed to a higher degree of temperature than 212°; but in the latter, especially when it is the object of the manufacturer to make amber rosin, the temperature to which they are exposed is much higher.

The first experiment I made was on the 16th March. I found the temperature of the boiling rosin, in the still, to be 250°, when the turpentine oil and water had been distilled off, the fire just drawn from under the still, and when the liquid rosin was in the act of being strained from the chips which were introduced into the still with the turpentine.

I had the whole of the chip cake resulting from this distillation carried into my own yard, upon a wire screen, and left in the open air, with a view of watching its progress.

The temperature increased gradually in the centre of the heap, although externally it became quite cold and brittle. In four hours, in fact, a thermometer thrust into the centre of the *porous* mass indicated a temperature of 400°, a good deal of vapour was now given off, and the adhering rosin in the heated parts began to acquire a high colour; the smell could be perceived at a considerable distance from my premises; it was a mixed smell of pitch and rosin.

The chip cake, in this experiment, was first exposed to the air at one o'clock in the afternoon, and though it rained during the night, at half past seven the following morning it burst into a flame.

In a second experiment, I placed the chip cake in an open tar barrel, having three holes bored in its bottom, about two inches in diameter each, and it did not take fire till the expiration of thirty-six hours, but the temperature of the mass was lowered by removal from the wire strainer to the barrel, and besides, I am of opinion the limited access of air retarded the combustion.

In a third trial which I made, combustion took place in five hours; but in this experiment the temperature of the boiling rosin drawn from the still was 260°, and the chip cake was laid, as in the first experiment, on the wire screen; the wind, too, was very high. The screen, in this case, was raised a few inches from the ground, in order to let the rosin, as it melted, drip away, which it did in abundance.

It appeared to me as if the porous mass became slowly red hot, in the centre, like a pyrophorous, and as if the vapour and gaseous matter arising from the decomposed rosin which lay immediately beneath, were inflamed on coming in contact with it. I was standing by when it suddenly burst into flames, and I thought, at the time, had the melted rosin been permitted to drop into water, or had it fallen to such a distance as not to be kept liquid by the radiant heat of the red hot mass above, that there would have been no flame, but silent combustion.

I have since learned from Mr. Price, in whose distillery it has always been the practice to put the unstrained turpentine into the still, that he was well aware of the fact which it is the object of this paper to record, from a fire having occurred several years ago on his premises, when in the possession of his predecessor, Mr. James Price, and that, ever since, they cool down the chip cake, immediately on removal from the still, with water, and afterwards use it as fuel under the still.

An instance of spontaneous combustion occurred with my friend Mr. Philip Coffey, of the Dock Distillery, which is worth relating while on this subject.

He had made a quantity of the mixture used in the theatres for producing redlight, a powder consisting of nitrate of strontian, sulphur, chlorate of potash, and sulphuret of antimony, with a little lamp-black. A paper parcel of this "red fire," of about a pound or two by weight, was left by him on a shelf in a store-room where there was no fire or candle-light; the following day, while reading in an adjoining room, he perceived a smell as if some of this powder were burning, and, on examination, he found it had ignited spontaneously on the shelf and was actually consumed.—[*Records of General Science, and Rep. Pat. Invent.*

Engraving on Copper in relief.—This art has fallen very undeservedly into neglect. Nitric acid, with one fifth of muriatic acid, forms the best mixture for biteing in.

To prepare the copper, cover it with fine pumice-dust and water, and rub with a piece of fine pumice stone, rubbing with a curved motion. When the whole surface is uniform, clean the plate carefully. The plate is now to be coated with a cement prepared as follows: pure and clean asphaltum, is coarsely powdered, and four ounces added to four of Burgundy pitch, previously heated to fluidity in a suitable vessel: the materials are well mixed and exposed to a gentle heat sufficiently long to vaporize all the water of the pitch. Six ounces of white wax are next added and the whole is gently heated until it has attained such a fluidity that on cooling it will have a proper consistence: a very important point in regard to it. The fluid is then poured upon a copper plate to cool, and broken into small pieces for use.

The cement just described is dissolved in oil of turpentine, then spread with a brush or pen upon those parts of the plate which are to stand out. With a steel point these lines are cut down to the proper degree of fineness.

When the cement is dry, make an inclosure by engraver's wax upon the plate, into which pour dilute nitric acid, and allow it to act as long as is necessary. Next clean the plate and with a roll of paper dipped in the cement give a coat of ink to the parts of the design. Bite in with stronger acid, and when the plate has again been inked and worked up with the grain, bite in with nitro-muriatic acid.

This operation affords an engraving in high relief and which may be worked off with very little touching. *(Jour. des Connaiss. Us. Prac. Aug.)*

Densities of Metals affected by Wire Drawing, &c.—In a memoir some of the conclusions from which have already been given in this journal, M. Baudrimont gives the following estimates of specific gravites, founded upon very delicate experiments. *Iron.*—Wires compressed, 7.6305; do. annealed 7.600; do. laminated 7.7169; do. annealed, laminated 7.7312; hammered iron 7.7433. *Copper.*—Button cooled slowly, 8.4525; wire compressed, 8.6225; do. annealed 8.3912; do. laminated 8.4931; do. annealed, laminated, 8.4719; hammered copper 8.5079. *Silver.*—Button slowly cooled, 10.1053; button laminated, 10.5513; hammered 10.4476; granulated 9.6323; brittle 9.8463; crystallized in plates 9.5538; wire of .007 inch diameter, 10.4913. *Annales de Chim. et de Phys. Vol. IX.*

Preparation of Sugar from Starch.—M. Guerrin Varey, gives the following process for preparing sugar from starch by the aid of malted barley. One hundred parts of starch are mixed in four hundred parts of cold water, the mixture is poured into two thousand parts of boiling water, and rapidly stirred. From this results a thin paste which is cooled to about 150° Fah. and an extract of thirty-five parts of barley, which has germinated, mixed in. Cold water is added. The temperature being kept at 140° to 150° Fah. the mass liquifies in about five minutes. Having been heated for two hours and a half, between the temperatures already named, the liquid is evaporated at the lower limit of temperature in vacuo, if possible, until it marks 34° of Baumé. It is then exposed to the air in shallow vessels, and in a few days yields a sirop which sometimes contains crystals. The sugars may be crystalized by treating with alcohol to purify them, and evaporating in vacuo. Animal charcoal is also used to deprive them of colour. *Ibid.*

Liquid for Bronzing Medals.—Water of ammonia ½ oz. nitre ½ oz. dry sea salt ½ oz. sal ammoniac 1 oz. vinegar 48 ounces.—*Jour. des Connais Us. et Prac. Sept.* 35.

Substitutes for Platinum Points.—Alloys which may be substituted for platinum points to lightning rods. Platinum 1, Zinc 1, Brass 1, Copper 6. Platinum 1, Mercury 1, Zinc ½, Brass ½, Copper 6. These alloys oxidate with difficulty.* *Ibid.*

Civil Engineering.

Proportion of drainage to fall of Rain.—The following deductions are made from two interesting tables, containing the fall of rain and the amount of drainage in Eaton brook and Madison brook valleys, in the State of New York. They are taken from a report of John B. Jervis, Esq., Chief Engineer of the Chenango Canal, to the Canal Commissioners of the State of New York.

From table No. 1. it appears, the average drainage, from June to December, 1835, inclusive, (7 months,) was 0.392 of the falling water or nearly ⅖; and the average from June to October, inclusive, (5 months,) was 0.319, or nearly ⅓ of the fall: August is the minimum month, and shows a drainage of 0.192, or nearly ⅕ the fall: July is the maximum month, (except December, which drained the snow of November,) and a drainage of 0.414, or over ⅖ of the fall.

From table No. 2, it appears, the average drainage for the year 1835, including the snow on the ground on the 1st of January, was 0.449, or nearly half the falling water: January to May, inclusive, (5 months,) 0.662, or say ⅔ of the fall: June to October, inclusive, (5 months,) 0.246, or say ¼ of the fall. It will be observed that the quantity drained from June to

---

* *Query.* Will they replace platinum in difficulty of fusion? if not, the points would become knobs, by powerful discharges.

October, inclusive, was very uniform; although the falling water is very different; which causes a great range in the ratios for the several months. This was produced by the reservoir on Madison brook, which retained the flood waters, and discharged them nearly uniformly through the reservoir pipes, causing the highest ratio to appear in the month of the least fall, and the smallest ratio in the month of the greatest fall of water. It is therefore obvious, that an average of June to October, (5 months) will be required to give a proper view of the drainage during the season of the greatest evaporation.

From June to October the Eaton brook valley gave a drainage of 0.319, and Madison brook valley 0.246 of the falling water. This result, it is believed, has been produced by the different characters of the two districts drained. The Eaton brook valley is, in itself, very narrow, and the grounds that drain into it are, generally, quite steep, and the soil is mostly of a very close texture. The Madison brook valley is much wider, the slopes of the adjoining lands that drain into it are more easy; and the soil, in some parts, is more porous than that on Eaton brook. In both cases the country is cultivated, and presents the usual proportion of cultivated and timbered lands, that is generally considered necessary in farming districts.

The Eaton brook valley, I should think, would afford more than an average drainage over a large district of the country, including the usual varieties of soil; and the Madison brook would, probably, not differ materially from the general average.

The calculations which the undersigned originally submitted on this subject were based on a drainage equal $\frac{1}{5}$ of the falling water, which the experiments thus far show to have been too low. The average for the year, for the Madison brook valley, is 0.449, or over $\frac{2}{5}$ of the falling water; and if we assume the drainage on Eaton brook, during the winter months, to be equal to that on Madison brook, for the same time, (which may be taken with safety,) the average for the year would be 0.523, or over half the falling water.

Rail Road from Hartford to the Canadian line.—The following is an extract from the proceedings of a convention held at Windsor, Vermont, for taking measures in regard to a Rail Road from Hartford, Connecticut, to the Canadian line.

The committee to whom was assigned the resolution directing an enquiry into the practicability of constructing the contemplated Rail Road from Hartford, in Connecticut, to the Canada line, through the valleys of the Connecticut and Passumpsic rivers, in reference to elevation, soil, materials, &c., and to estimate the expense of the same, beg leave to report:—

That, in their opinion, the same is highly practicable; that they have had under consideration the survey of Mr. Hutchinson through the valley of the Connecticut river from Hartford, in Connecticut, to McIndoe's Falls, in Barnet, Vermont, near the mouth of Passumpsic river, a distance of 220 miles, and the survey of De Witt Clinton, Jr. from thence to the Canada line on Lake Memphremagog, a distance of about 65 miles, showing a plan and profile of the country, surveyed for a canal on said route, being the same which is now contemplated for a Rail Road. Knowing those gentlemen to be professional engineers of high respectability, your committee have not hesitated to come to the conclusion, unanimously, that, so far as rise and fall are to be regarded, no unusual obstacle is presented; that, for so great an extent, the route is uncommonly level, and that there is no one point of obstruction in the whole extent which may not be readily overcome, and that without serious expense.

That, in reference to the soil, in addition to the knowledge possessed by the committee individually, they have acquired such information as has been within their reach, and feel confident in affirming that throughout the whole route, the earth is feasible and of easy excavation; and that all the materials for constructing a rail road are found abundant and cheap upon every part of the line.

Your committee report, in reference to the expense of constructing said Rail Road, on the most permanent and improved plan, similar to the Boston, Worcester, and Providence roads, that the cost of superstructure, exclusive of grading, will be eight thousand dollars per mile, for a single track, including turn-outs; and that the grading, on an average, will not exceed five thousand dollars per mile for a double track, including masonry, bridging, engineering, and all contingent expenses. But, considering the abundance of timber in the vicinity of the route, suitable for constructing a rail road, and the facility for obtaining the same, other plans equally practicable and far less expensive might be advantageously adopted. The superstructure of the road with timber, without rubble-stone, might be constructed for six thousand dollars per mile less than the estimates of a road similar to the Worcester and Providence roads.

The estimated expense of a road, the whole distance, constructed upon the plan first mentioned, would amount to	$3,705,000
Upon the last mentioned plan,	1,995,000
Making a saving in expense of	$1,710,000

It is well known that the surveys of Messrs. Hutchinson and Clinton were made for a then contemplated canal, and, of necessity, must have been confined to the streams; but in a survey for a Rail Road it seems highly probable to your committee that the route will be varied in many essential particulars.

Your committee further report, from the best information they have been able to obtain, that the route from the line of Canada to St. John's, a distance of about seventy miles, intersecting the Champlain and St. Lawrence Rail Road, is highly practicable and through a level and fertile country, and that from the well known enterprise of the inhabitants of the Eastern townships in the Province of Lower Canada, should the now contemplated Rail Road be extended to the Province line, a communication would soon be opened from that *terminus* to Montreal, and that the expense of constructing the same will not exceed the foregoing estimate; and they further report, that there is another route, in contemplation from the province line, through the valley of the St. Francis to the St. Lawrence, in the direction of Quebec, which is represented to be equally practicable, and affording equal facilities.

Thames Tunnel.—The excavation made for the Thames Tunnel is about 38 feet in width, and 22 feet six inches in height, presenting therefore, an opening exceeding 850 feet. The whole of this excavation including its two sides, which may be computed at 400 feet, is secured by means of a powerful apparatus designated the shield, as is also the roof it, which measures 350 feet. At full tide, the weight of both earth and water, which constitute *the superincumbent pressure*, is not less than 700 tons.

The *ceiling* of the shield consists of 24 or 26 pieces of cast-iron, donom inated staves, closely adjusted; and as they are sometimes made to relieve each other, and therefore subjected to an increased load, they are for greater strength made like inverted troughs of cast-iron; their breadth is 18 inches, the depth of their sides 7 inches, and their length 9 feet, independently of a tail of wrought-iron which overlays the brick work. The edges in front are made sharp for entering the ground, and the external surfaces of the staves are planed very true. Similar staves are laid against the sides of the shield, all planed and equally well adjusted; each stave can be impelled singly as sheet piles are. Upon the whole the shield may be viewed as a coffer-dam, which, instead of being moved in a perpendicular direction, is placed and impelled horizontally. The standing part of the shield consists of 12 parallel frames, all independent of each other.

The front of this vast excavation is protected in a different manner from that of the sides. It is paneled all over with small boards, each of which is 3 feet long and 6 inches wide. There are, therefore, upwards of 500 of these boards, technically called *polings*, for covering the whole face of the excavation. Every one of these polings is held in place, and secured by means of two hand-jacks or screws, abutting against the frames. There are, therefore, upwards of one thousand of these jacks in action for securing the face of the excavation, or rather, for pressing against the ground with sufficient power to prevent any disruption of its various strata; for were the ground to be at all deranged, the pressure against the sides and front of the shield might soon increase to 2,500 or 3,000 tons, independently of that of the superincumbent pressure.

It is further to be remarked, that every successive tide, which at its full head is 76 feet above the foot of the excavation, causes an incessant variation in that pressure, tending to strain the hard strata, and to soften or knead the intervening soft ones; a fact quite unnoticed by projectors of plans, but which proved fatal to those who attempted the drift-way under the Tames in 1808. The pressure exerted against the front of the excavation by the agency of the shield, must therefore be uniformly kept at a maximum. The shield is advanced only 9 inches at a time, while the brick structure proceeds simultaneously.

It would be well if those who feel disposed to enter the List of Competitors were first to consult the report of those miners who directed the attempts that were made and carried on with so much perseverence, between the years 1803 and 1808, with the ultimate object of opening a roadway under the Thames at Rotherhithe. These were miners (Cornishmen,) engineers in that branch of the art, and, consequently, eminently qualified for the task in every respect; they were as sanguine too, as any of the projectors of this day; and their excavation was limited, in the first place, to a simple driftway, the height of which was only 5 feet, the breadth 2 feet 6 inches at the top, and 3 feet at the bottom, forming, therefore, an excavation that was sixty times smaller than the excavation which has been made for the Thames Tunnel. Diminutive, however, as this hole was when contrasted with that of the tunnel, the ground of the roof, though supported by substantial planking, gave way once in a fluid state, leaving an unsupported cavity over the roof of the driftway; still it held itself up; but a second accident of the same nature having occurred under a very high tide, the river broke the ground and entered the drift. In both cases it was the loose ground that first forced its way into the drift, and the river afterwards. The miners succeeded in filling the hole and in re-entering the drift, but the men could not continue the working; they were, according to the engineer's report, *driven out of it by the frequent bursts of sand and water*, and it was acknowledged by him to be quite impracticable to proceed farther; so, after having probed the ground from underneath in many places, he concluded and reported that it was impossible to make an excavation of any size under the Thames.

But he resorted to one expedient which he conceived would answer the emergency—one which, at any rate, demonstrates the intrepidity of this engineer. That is, in order to clear or pass through the place which had been filled up in closing the hole made by the breaking in of the river, he reduced the height of his drift from 5 to 3 feet. The men and the engineers, too, had therefore to work on their knees. Awful enough for such a task! Thus reduced, the area of the excavation of this drift hardly exceeded the one-hundredth part of that of the Thames Tunnel under corresponding circumstances. [*London Mechanics' Magazine.*

General Statement of the Business of the Schuylkill Navigation Company, since its commencement.

In 1815–16–17, no receipts. In 1818, total tolls, 233 00 dolls; in 1819, 1,202 16; in 1820, 803 07; in 1821, 1,792 60; in 1822, 1,054 97; in 1823, 1,964 38; in 1824, 635 00.

Years.	Total tonnage.	Tons of coal.	Toll on coal.		Toll on other articles.		Total toll.	
			d.	*c.*	*d,*	*c.*	*d.*	*c.*
1825		6,500	9,700	00	6,075	74	15,775	74
1826	32,404	16,767	25,147	00	18,961	87	43,108	87
1827	65,501	31,360	33,317	00	24,832	74	58,149	74
1828	105,463	47,284	46,202	00	40,969	56	87,171	56
1829	134,524	79,973	77,032	00	43,007	00	120,039	00
1830	180,755	89,984	87,192	00	60,973	95	148,165	95
1831	196,413	81,854	78,781	00	55,224	32	134,005	92
1832	327,921	209,271	199,784	00	65,045	70	264,829	70
1833	445,849	252,971	228,138	00	97,348	00	325,486	63
1834	395,720	226,692	204,490	14	95,350	91	299,841	05
1835	535,194	339,508	310,475	19	120,168	45	433,643	64

Years.	Descending toll.		Ascending toll.		Amount of rents.	
	d.	*c.*	*d.*	*c.*	*d.*	*c.*
1825	13,363	74	2,412	00	4,700	00
1826	32,968	97	10,139	90	4,900	00
1827	42,865	27	15,284	47	6,967	00
1828	64,001	56	23,170	00	7,618	00
1829	92,186	00	27,853	00	10,574	00
1830	105,231	36	42,934	59	13,800	00
1831	99,995	52	34,010	40	13,750	00
1832	218,218	00	46,611	70	15,207	00
1833	263,744	00	61,743	63	16,673	00
1834	246,266	14	53,574	91	16,687	67
1835	362,861	36	70,782	28	17,898	54

Progress of Physical Science.

The Time Ball at Greenwich.—The following is a description of this apparatus.

C, the ball.

A D, a square mast on which it traverses, projecting through the eastern turret, *t*, *t*, of the observatory, and through the centre of the ball.

m m, the lead flat of the great room of the observatory.

O B, a circular iron plate, in which the mast is stepped, and which is steadied by the roof of the turret at *g*.

F G, an iron rod, to the upper part of which is fixed a part of the mast, and to the lower part, the piston, *G*. The upper end of this rod is of larger diameter than the lower.

I, an iron cylinder, with a stop-cock at *q;* the base, *a a*, on which it stands, being the level of the floor of the great room.

R S T Y, the discharging rod.

V, the cock, and W, the trigger, for discharging the ball.

M, the winch for raising the ball.

N, the chain for lifting the ball, and passing over the pulley at *O*.

H H, a strong iron plate, fixed in the wall, on which stand the two iron rods, *I I*, and which are fixed at the top, in the circular plate, O B.

k. These rods guide the piston rod, and also an iron weight, K, (passing through the lower part of it,) to the back of which weight is fastened the end of the lifting chain, *N*, after passing over the sheave at *O*.

The construction of the mast, and the manner in which the ball is made to traverse up and down it, is as follows.

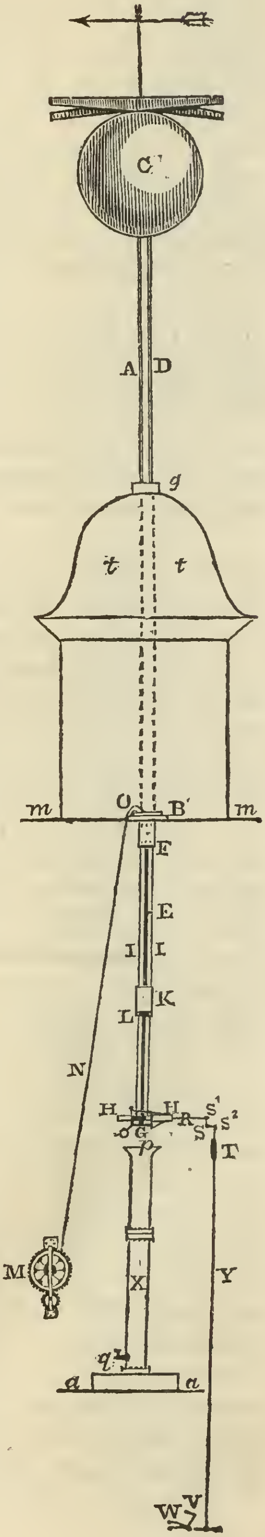


Fig.3.

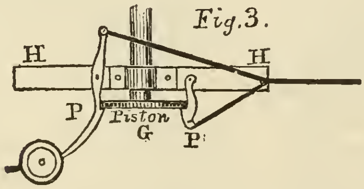


Fig. 2.

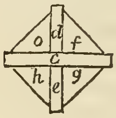


Fig. 2, represents a section of the mast at *d*, which will assist in explaining its construction. *c* is a solid piece of deal, (the whole length of the mast;) *d* and *e*, two other pieces screwed to it. The three angular parts, *h g f*, thus left, are filled by pieces extending the whole length, and firmly screwed in their places; but the part *o* is fitted by a piece, the upper end of which is secured to the upper part of the ball, and the lower end to the top of the piston rod at F.

When the ball is down, the weight, *K*, to which the chain is fastened, rests on the iron plate, *H H*, and the top of the piston rod, *F*, rests on a projecting piece at the bottom of the weight at *L*. The chain being fastened to this weight by means of the winch, is made to draw it, and, with it, the piston rod and ball.

The piston, *G*, being raised (as shown in the figure) to the iron plate, *H H*, forces its way between two detents, *P P*, which open and close on it, and thus support the ball.

The discharging rod, *R S T Y*, has a crank at S, with two joints at s^1 and s^2. T is a box, containing a strong spiral spring; the rod *Y* is secured to the bottom of this box, but the part of the rod above the box *T*, and below the crank at *S*, has a short movement within the box, in connexion with the internal spring. The purpose of this spring is, by acting against the ascent of the ball, when it is raised to the mast-head, to accelerate its descent when let fall, thereby preventing any adherence to the mast, and giving it rapid motion immediately.

V, the discharging part, has two notches, which serve to fix it at half and whole cock, in the same manner as the lock of a gun. When the ball is to be raised, the handle at *V* is raised to the half-cock; this raises the rod, *G*, and pushes the part, *R*, and prepares the detents, *P P*, for receiving the piston, which detents open, and are closed by means of the crank and the spring at *T*. When *V* is raised to the full cock, it compresses the spring, and exerts a greater force in keeping the detents closed. When the trigger, *W*, is pressed down, to discharge the ball, the rod, *G*, descends, and draws the part of the rod, R, to the right, which, removing the detents, *P P*, from beneath the piston, allows it to drop into the cylinder. The piston being adapted to the size of the cylinder, as it descends, compresses the atmosphere, and a resistance is thus obtained sufficient to break the fall of the ball, with its supporting rod in the mast. A brass cock at the bottom of the cylinder regulates the escape of the atmosphere beneath the piston, so as to allow the fall of the ball to be more or less, as required.

Fig. 3 shows, on a larger scale, the plan on which the detents are constructed.

When the ball is first raised to the mast-head, the weight, K, is at *F*; for the shoulder of the piston at *F*, resting on the rim of the weight at *L*, is thereby raised up with the ball. But before the ball is discharged, the lifting chain is entirely unwound, and the weight, *K L*, thereby descends, and rests on the plate, *H H*, in order to give the piston and ball freedom to descend.

During the time that it has been used, the ball has always been observed to commence its descent with 0.2s. after the impulse has been given to the trigger.

The time of discharging the ball is at the instant of one hour, P. M., mean time at Greenwich.

The mast is surmounted by a weathercock, and letters pointing to the four quarters of the compass. [*Lond. Naut. Mag.*

Occurrence of the Aurora Borealis at Toronto.—Capt. Bonnycastle, R. Engineers, states that "during the winter months, on Lake Ontario, the aurora may be said to be almost a constant companion of the dark and cheerless nights, and it occasionally presents itself at all other times of the year." He notices a remarkable constancy in the figures of the annual arches, as seen at Toronto, Upper Canada, and the constant appearance of the meteor in the arched form.

A splendid aurora occurring on the 11th December, 1835, is described and beautifully illustrated. [*Silliman's Journal, vol. XXX., No.* 1.]

Machine for Registering the Variations of the Tide and Wind.—The general principle of the machine is such, that a circular dial being fixed to the axle of a clock, revolves with a uniform motion once in twenty-four hours; a pencil is also moved vertically up and down by the rise and fall of the tide; which combined motions of the dial and pencil trace a curve upon the face of the dial, whereby the height of the tide, at any particular period of time, may be ascertained; also the time of high and low water, and the variable rate of ascent and descent.

The direction of the wind is indicated by a circular dial, fixed horizontally to the vertical axis of a wind-vane; and, by means of the clock, a pencil is made to move uniformly, at a given rate, from the centre of the dial, towards the circumference, so that, if the wind remain stationary upon any point of the compass, the mark traced by the pencil will be a straight line, radiating from the centre of the dial; but if the wind be changing, the dial will revolve, and the combined motions of the dial and pencil will trace out a curve, by which the direction of the wind, at any particular period of time, will be indicated. [*Jameson's Journal.*

Colour of the sky as seen from high mountains.—M. Bousingault comparing his own observations upon several high mountains, is disposed to attribute the blackness which the sky sometimes presents, to the effect of strong light reflected from the snow and ice upon the eyes. He observed a remarkable difference of tint in the sky seen from the highest point of Chimborazo which he was able to reach, and from the plain. On the ascent of Antisana at a much lower elevation, the sky seen from the icy plain appeared black, and in the evening of the day of observation he was struck with snow-blindness.

In no ascent has he been able to see the stars in day time, an experiment which he made fully in his ascent of Chimborazo. [*Ann. de Chim. et de Phys.*]

Height of Barometer, &c. near the top of Chimborazo.—On his ascent of Chimborazo, M. Bossingault found the barometer to stand at 14. 47 inches at 2 P. M., the thermometer being at 46° Fah. The height above the level of the sea was 6004 netres (6670 yards.) [*Ibid.*

Expansion of Liquified Gases, &c.—The very remarkable fact of the expansion of liquified carbonic acid, lately observed by the French academicians, has been fully verified by Mr. Kemp, lecturer on chemistry, who finds that the expansion is not peculiar to this liquified gas, but belongs to all other gases in the liquid state. At a meeting of the society of arts, Mr. Kemp exhibited a specimen of the liquified sulphurous acid gas, hermetically sealed in a glass tube, and separated from the materials from which it had been generated. This specimen of the liquified gas occupied eight inches of a tube, five-eighths of an inch in internal diameter, and when cooled from the temperature of 60° down to 14° of Fahr., or the point at which it becomes liquid under the ordinary pressure of the atmosphere, it contracted one inch; but when heated an equal number of degrees above 60°, viz. 46°, it expanded through a greater distance than it had before contracted, by the abstraction of an equal amount of caloric, showing that the expansion went on at higher temperatures in a slightly increasing ratio, so that the expansion between its liquifying point, viz. 14° and 212°, the boiling point of water, is nearly one-third of its whole volume, the pressure against the expansion being at 212°, about twenty-five atmospheres. That this property does not belong to the liquified gases exclusively, but resides equally in all other fluids, when raised above their boiling points, is shown by the following experiment; thus, ether, when raised from the temperature of 60° to 95° of Fahr., or its boiling point, undergoes an inconsiderable expansion compared with the expansion produced by an equal increase of temperature above its boiling point, when it may be said to be in the same condition with the liquified gases, in regard to pressure, and suffers nearly an equal expansion, by an equally increasing temperature with the liquified gases. [*Jameson's Jour.*

Arsenic in English Sulphuric Acid.—Vogel, of Munchen, infers, from his experiments on sulphuric acid:

1. That the Nordhausen acid, prepared from the sulphate of iron, contains no arsenic; the precipitate with sulphuretted hydrogen being pure sulphur.
2. Concentrated English sulphuric acid, prepared in leaden chambers, contains arsenic, and the precipitate produced in it by a current of sulphuretted hydrogen, consists of sulphur and orpiment.
3. No precipitate of sulphur takes place, in consequence of a current of sulphuretted hydrogen being passed through English sulphuric acid, diluted with from four to six parts of water; the precipitate consisting of an orange yellow powder, or orpiment.
4. Rectified English sulphuric acid contains no arsenic, this substance remaining in the residue. The rectified acid, diluted with water, is not rendered muddy by sulphuretted hydrogen. The German sulphuric acid, diluted with water, becomes white when the latter gas is passed through it, as it always contains sulphurous acid.
5. The arsenic always exists in sulphuric acid in the form of arsenious acid, never as arsenic acid.
6. Concentrated boiling sulphuric acid can dissolve one-third of its weight of arsenious acid, of which the greater part separates on cooling. The arsenious acid may be precipitated, in a great measure, from the concentrated sulphuric acid, when cooled, by absolute alcohol, although it is somewhat soluble in alcohol.
7. Lastly, it is absolutely necessary that in all preparations to be used internally, rectified, or, at least, German, sulphuric acid, should be employed. [*Thomson's Rec. of Sc.*

On the Mineral Waters of Nevis.—M. Robiquet attributes the principal virtue of these waters to an organic substance heretofore described by M. Longchamps, and called *baregene*, but which M. Robiquet refers to the vegetable kingdom as an organised matter. The nitrogen which enters into the constitution of this plant, is derived, according to the same writer, from atmospheric air, existing in cavities through which the waters pass. When the spring water is first drawn nitrogen escapes, and the water, notwithstanding its high temperature 112° Fah. retains a mixture of nitrogen and oxygen, in which the latter element is in greater proportion than in atmospheric air. [*Ann. de Chim. et de Phys. vol. LX.*

Analysis of the waters of the Gray Sulphur Springs.—The springs "are situated among the spurs of that portion of the Allegheny mountains which passes through Virginia, on the borders of Monroe and Giles counties." The waters analysed by Prof. Shepard, of South Carolina College, have yielded Nitrogen, Chlorine, Carbonic Acid, Sulphuric Acid, Hydro-Sulphuric Acid, Silica, Crenic Acid, Soda, Lime, Alumina, Iron and Sulphur.

These constituents, he states, from his examination, exist probably as Nitrogen, Hydro-Sulphuric Acid, Bicarbonate of Soda, a super Carbonate of Lime, Chloride of Culcium, Chloride of Sodium, Sulphate of Soda, an alkaline or earthly crenate, or both, Silica, Sulphuret of Iron, per crenate of iron, Alumina, Silicate of Iron. [*Silliman's Journal, vol. XXX. No.* 1.

Mechanics' Register.

British Projects for 1835.—The following abstract is made from an article in the London Magazine of Popular Science, for February, 1836, where the particulars are given at large:

Number of projects relating to steam, ten; amount of capital required, 1,889,000*l.* Gas, three projects; capital required, 295,000*l.* Mines, forty-one; capital, 3,006,200*l.* Railways, thirty-seven; capital, 35,424,000*l.* Miscellaneous, thirty; capital, 9,343,000*l.* Total capital required, 49,957,200*l.*, or nearly $204,000,000! A few of them are foreign schemes.

Desiderata in the Construction of Stage Coaches.—The greatest possible height of all the wheels; greatest possible depression of the body; shortness of perch; length of axletrees; diminution of bearings and tires; length and pliancy of springs. [*Parnell on Construction of Coaches. Rev. in Lond. Mag. Pop. Sc.*

Beet Root Sugar.—At the recent meeting of the German naturalists, at Bonn, the section of agriculture and rural economy was almost entirely occupied with papers and discussions on this subject. At Valenciennes, a manufacturer has succeeded in discovering a method of crystalizing the whole of the saccharine matter of the beet, without producing molasses in the process. [*Ibid.*

Harrison's Chronometers.—It is stated that Harrison, of London, received from the government for his chronometers, at different times, sums amounting to one hundred and ten thousand dollars. [*Naut. Mag.*

Hint to Dyers.—A practical dyer of Troyes, in France, asserts that the acetate of iron is much preferable to the sulphate, in dying blacks. That stuffs which are injured by washing in caustic leys, or even soap, may be cleansed by rubbing in a weak starch bath. [*Bulletin Soc. d'Encouragement, &c.*

Hint to Bleachers.—The same individual states that muriatic acid, used instead of sulphuric, in decomposing bleaching salts, does not render woolen goods harsh, as is often the result of the common acid bath. [*Ibid.*

Cast-iron Piano.—The society for encouraging the arts at Rouen, France, have awarded a premium to Messrs. Eder & Gaugain, for a piano, the frame of which is of cast-iron. The strength of this material, in proportion to its bulk, gives it advantages over wood. [*Ibid.*

Experiments on Hydraulic Cements.—The society for the encouragement of national industry in France, have appropriated six hundred francs for experiments on the different hydraulic cements. [*Ibid.*

Preserving Marble by Wax.—It is well known that some of the inferior varieties of marble are acted upon by frost. A Mr. Henning, in London, has preserved several sculptured pieces, by causing them to imbibe wax. The stone and wax are both heated. [*Lond. Mech. Mag.*

Steamboat Lexington.—This boat, which ran, during the summer, between New York and Providence, making the passage by daylight, is discussed in the London Mechanics' Magazine, under the title of the "Fastest Ship in the World."

Greenwich Railway Project.—This extraordinary project is to carry a railway upon a viaduct from London to Greenwich, three and three-quarter miles, on a series of between 900 and 1000 arches. This *arcade* to be a series of shops.

Action of Salt Water on Cast-iron.—Sea water so alters the nature of cast-iron, that its cohesion appears to be quite destroyed. Cannon which have been fished up, after lying long in the sea, have been found converted, through their substance, into something resembling plumbago, and admitting of being cut with a knife. [*Mining Journal. Naut. Mag.*

Statue of Brick and Mortar.—A statue of the late king George the Fourth, erected at London, is built of bricks and mortar, coated, we presume, with cement. [*Loudon's Arch. Mag.*

Whalebone Pen-holders.—These holders for metallic pens are highly recommended for flexibility, by a correspondent of the London Mechanics' Magazine.

Mineral Pitch Lake of Trinidad.—This extraordinary body of mineral pitch is about half a mile in length, and a sixteenth of a mile in breadth. Numerous pools of water exist on its surface. The mineral is hard enough to bear the weight of a man of common size, unless when heated by the sun. It is unlike vegetable pitch, being allied to coal. It is used by the inhabitants of Trinidad for making roads, and cementing stones under water. Gas has been made from it. [*Jameson's Journal, from Webster's Voyage.*

Canadian Twin Steamboat.—A large steamboat is said to have been constructed at Prescott, Upper Canada, upon a principle similar to that of Mr. Burden, but with improvements. The thing will prove, probably, as little applicable to practice in the improvement, as in the original.

Erection of the York Column.—This monument, recently erected at London, to the Duke of York, is a Tuscan column, surmounted by a statue. The weight of the statue is 16,480 lbs., and it was raised to its place, 123 feet from the base of the column, in seven hours. It is said to have been greater in weight than any other statue raised to the same height in Great Britain.

List of American Patents which issued in March, 1836.

	March.
141. *Rolling Dough and Cutting Crackers.*—Wm. R. Nivins, city of New York,	2
142. *Power Printing Press.*—Isaac Adams, Boston, Mass.	2
143. *Fire Place and Stove.*—Foster Stevens, Springfield, Mass.	2
144. *Heat, management of.*—Lovell Lewis, Lewistown, N. York,	2
145. *Washing Machine.*—John O. Geer, Norwich, Connecticut,	2
146. *Fire Proof Safe.*—Daniel Harrington, Philadelphia,	2
147. *Cask and Barrel Headings.*—Hiram Andrews, Canaan, Conn.	2
148. *Mill Stone Picks.*—Samuel Etheridge, Tecumseh, Mich.	2
149. *Boring Wood.*—John B. Bell, New York city,	2
150. *Piano Forte.*—Issac Clark, Cincinnati, O.	2
151. *Brick Press.*—Phineas Ball, Mount Vernon, O.	2
152. *Furnace and boiler combined.*—Alexander Harrison, New Haven, Conn.	2
153. *Saw Mills.*—Isaac Reed, Mansfield, Mass.	2
154. *Carriage and car axle.*—Spenser Coleman, Mount Pleasant, Va.	2

155.	*Dough Machine.*—D. D. and T. Shackford. West brook, Maine,	2
156.	*Rotary stove caps.*—Maynard French, Albany, N. York,	2
157.	*Feather Renovator.*—J. W. Post and R. Collier, Baltimore, Md.	2
158.	*Churn.*—Amos Hanson, Windham, Maine,	2
159.	*Printing Press.*—Samuel Kingsley, N. York city.	2
160.	*Gauges, making.*—M. M. Brainard, Gt. Barrington, Mass.	4
161.	*Pitch, composition.*—Thomas H. Sherman, Scriba, N. York,	4
162.	*Gypsum applied to cisterns,* &c.—J. Flint and C. Mills, N. York city,	4
163.	*Lever key and lock.*—Augustus Prutzman, Philadelphia,	4
164.	*Rail road cars.*—T. Davis and W. Ashdown, Baltimore,	4
165.	*Water Wheel.*—Fred. Wingate, Augusta, Maine,	4
166.	*Plough.*—W. P. Cannon, Monroe co. Tenn.	4
167.	*Rudder.*—Samuel Kepner, Harrisburg, Pa.	4
168.	*Boots, turning.*—Pelatiah Stevens, Stoughton, Mass.	4
169.	*Printing Press.*—Hezekiah Camp, Trenton, Ohio,	4
170.	*Smoke, consuming.*—Nathan Lockling, Sparta, N. York,	4
171.	*Cotton gin grates.*—Edwin Keith, Bridgewater, Mass.	4
172.	*Plough.*—D. Prouty and J. Means, Boston, Mass.	4
173.	*Propelling Wheel.*—Arctus A. Wilder, Warsaw, N. York,	8
174.	*Pump, double force.*—Levi Newton, Alexander, N. York,	8
175.	*Splint for fractures.*—Enoch Thomas, New Athens, O.	8
176.	*Smut machine.*—M. B. Spafford, Gainsville N. York,	8
177.	*Pot and pearl ash.*—Elijah Williams, Erie, Penn.	8
178.	*Mould candles.*—Jefferson Dunlap, New Holland, Penn.	8
179.	*Brick Machine.*—John Moffat, Buffaloe, N. York,	8
180.	*Appling heat from lime,* &c.—Peter Werm, Philadelphia,	8
181.	*Steam generator.*—Job Car, Springborough, O.	12
182.	*Washing machine.*—Albion P. Arnold, Readfield, Maine,	12
183.	*Forcing pump.*—William W. Lesuer, Venice, N. York,	12
184.	*Water wheel.*—Abraham Straub, Milton, Penn.	12
185.	*Bed bug destroyer.*—Brittain Garrard, Maysville, Tenn.	12
186.	*Fire places.*—Elijah Skinner, Sandwich, N. H.	12
187.	*Cooking stove.*—John Liddle, Schohaire, N. York,	12
188.	*Door locks.*—Abel Corant, Lowell, Mass.	12
189.	*Fire place.*—William Burgess, Middleborough, Mass.	12
190	*Cap wire.*—Melville Kelsey, N. York,	12
191.	*Piano fortes.*—Henry Hartge, Baltimore, Md.	12
192.	*Capstan.*—Andrew Morse, Boston, Mass.	12
193.	*Cotton press.*—J. Mitchell, Ruthford, Tenn.	12
194.	*Tooth extractor.*—Moses P. Hanson, Bangor, Maine,	12
195.	*Paper, drying.*—Henry Howe, Shirley, Mass.	12
196.	*Blacksmith's forge.*—Charles Richardson, Greenfield, N. H.	12
197.	*Steam generator.*—John Ames, Springfield, Mass.	12
198.	*Butt hinges,* &c.—Welcome Whittaker, Troy, N. York,	12
199.	*Detaching horses.*—Phillip T. Shore, Baltimore, Md.	18
200.	*Braces, gum elastic.*—Ransom Warner, New York,	18
201.	*Making extracts.*—T. Close and J. C. Sandford, Rye, N. York,	18
202.	*Cook stoves.*—Charles Vale, Newark, N. J.	18
203.	*Tanning.*—Henry Locher, Lancaster, Penn.	18
204.	*White lead, making.*—Homer Hollard, Westfield, Mass.	18
205.	*Hemp breaking machine.*—John Pursell, Perryville, Ken.	18
206.	*Serving ropes.*—Adam Montgomery, N. York,	18
207.	*Salt, making.*—Richard K. Crallé, Lynchburg, Va.	18
208.	*Metallic mill.*—Joseph C. Dentry, Dayton, O.	18
209.	*Morticing machine.*—George Page, Keene, N. H.	18
210.	*Feathers, dressing.*—Elam Wilbur, Geneva, N. York,	18
211.	*Door lock.*—James McClory, N. York,	18
212.	*Pitch, making.*—Henry Ruggles, N. York,	19
213.	*Fire places.*—Wm. R. Prescott, Hallowhill, Maine,	19
214.	*Steam Generator.*—Eliphalet Nott, Schenectady, N. York,	19
215.	*Pen and pencil case.*—Henry Withers, N. York,	19

216. *Fore anvil block.*—Samuel Van Tiers, Hanover Iron Works, Penn. 19
217. *Boats, passing over dams.*—Stephen Underwood, Bath, N. H. 19
218. *Tanning.*—Laban Emery, N. York, 19
219. *Milk, preserving.*—John L. Granger, N. York, 19
220. *Cider mill.*—Christian Shaeffer, Lebanon, Penn. 19
221. *Cooking stove.*—Oren Wilson, Concord, Mass. 23
222. *Stove.*—Wm. M. Carmichael, Hempstead, N. Y. 23
223. *Shoe pegs.*—Reuben H. Thompson, Rochester, N. York. 23
224. *Cot bedsteads.*—Samuel Clark, N. York, 23
225. *Cask machine.*—Sumner King, Suffield, Conn. 23
226. *Dissolving caoutchouc.*—Patrick Mackie, N. York, 23
227. *Washing machine.*—E. Y. Watson, Albany, N. York, 23
228. *Cannon vent.*—John W. Cochran, Lowell, Mass. 23
229. *Cannon.*—John W. Cochran, Lowell, Mass. 23
230. *Mortising machine.*—Erastus M. Shaw, Wilbraham, Mass. 23
231. *Cotton roping.*—William Fowler, Fishkill, N. York, 23
232. *Straw cutter.*—James Hyde, Darien, N. York, 23
233. *Thrashing machine.*—Hugh and Isaac W. Edgar, Wayne co. Ohio, 23
234. *Rotary steam engine.*—David Ulam, Greenburgh, Penn. 23
235. *Boring stones.*—Andrew Turney, Reading, Conn. 30
236. *Bee hives.*—Sturgess M. Judd, Danbury, Conn. 30
237. *Forcing Pumps.*—John F. Rogers, Waterford, N. York, 30
238. *Power loom.*—Francois C. Lewis, Grafton, Mass. 30
239. *Mill.*—John Harman, Jr. York, Penn. 30
240. *Harness, rivetting.*—William Dukehart, Baltimore, Md. 30
241. *Water wheel.*—Carey S. Mercer, Franklin, Md. 30
242. *Wool spinning.*—John Wethered, Baltimore, Md. 30
243. *Cotton planter.*—Michael Beam, Buffalo, N. C. 30
244. *Lamp reflecting.*—John C. Fletcher, Springfield, Ohio, 30
245. *Hat block.*—W. W. Jeineson, Wheeling, Ohio, 30
246. *Joints in wood work.*—S. C. Batchelor, and N. S. Thomas, Watertown, N. Y. 30
247. *Wool spinner.*—Sykes and Conradt, Fredericktown, Md. 30
248. *Stove.*—John B. H. Swansey, Lynn, Mass. 30
249. *Hay,* &c. *press.*—A. R. Chamberlain and A. Cleflin, Richmond, Maine. 30
250. *Wind mill.*—Job Wilbur, Fall River, Mass. 30
251. *Axes, manufacturing.*—Elisha R. Root, Canton, Conn. 30
252. *Forcing pump.*—Nathan Chapin, Penn Yan, N. York, 30
253. *Cotton plough,* &c.—Harvey W. Pitts, Wilsonville, Al. 31
254. *Corn sheller.*—Abert W. Gray, Middletown, Ver. 31
255. *Springs for carriages,* &c.—Newell Hungerford, Ithaca, N. York, 31
256. *Awl Haft.*—David M. Smith, Gilsum, N. H. 31
257. *Soles, cutting.*—Jonathan Hill, Belerica, Mass. 31
258. *Reflecting ovens.*—C. D. Van Allen, Penn Yan, N. York, 31
259. *Self motive power.*—J. J. Giraud, Baltimore, Md. 31
260. *Churn.*—Thomas Nicholson, New Market, Va. 31
261. *Hoe, cast iron.*—Benj. F. Boyden, Boston, Mass. 31
262. *Winnowing machine.*—Jonathan Beane, Montville, Maine. 31
263. *Conveying water.*—Samuel Hart, Baltimore, Md. 31
264. *Tew irons.*—John Shugert, Elizabethtown, Penn. 31
265. *Mill stones, cooling.*—Austin Taylor, Littleton, N. H. 31
266. *Spark catcher.*—Wm. Shultz, Philadelphia, 31
267. *Horse power.*—Richard Skinner, Williamson, N. York, 31
268. *Cooking stove.*—B. R. Pearson, Warner, N. H. 31
269. *Hydrant.*—David Horne, Baltimore, Md. 31
270. *Rail plates.*—A. M. McCrane, Montgomery, Ala. 31
271. *Rail roads.*—Nathan Reed, Belfast, Maine, 31
272. *Cancer ointment.*—Elias Gilman, Licking, O. 31
273. *Gripe chuck.*—David Peeler, Boston, Mass. 31

CELESTIAL PHENOMENA, FOR JULY, 1836.

Calculated by S. C. Walker.

Day.	H'r.	Min.					
5	13	3	Im. μ Piscium,	,5,		N. 155°	V. 106°
5	13	55	Em.			266	217
21	8	43	N. App. ☽ and λ Virginis,	,4,	☽ S. 0′.5		
24	8	28	Im. A Ophinchi,	,4,5,		80	75
27	9	46	Em.			253	262

Meteorological Observations for March, 1836.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.	Direction.	Force.		
				Inches	Inches			Inches.	
	1	30°	35°	29.60	29.00	S. SW.	Moderate.		Sleet—rain.
	2	22	23	.73	30.00	W.	Blustering.		Clear day.
☺	3	20	38	30.06	.10	W.	Brisk.		Lightly cloudy—clear.
	4	26	44	.03	29.90	WSW.	Moderate.		Clear day.
	5	30	34	29.53	.60	SW. W.	Brisk.		Clear—lightly cloudy.
	6	21	34	.80	.83	NE. N.	Blustering.		Cloudy day.
	7	29	41	.73	.73	W.	do.		Cloudy—flurry of snow.
	8	29	39	.68	.68	SE. W.	do.		Cloudy—clear.
	9	20	44	.86	.90	NE. SE.	do.		Clear—lightly cloudy.
☾	10	29	38	.80	.55	SE.	do.		Fog—rain.
	11	31	33	.50	.65	W.	Blustering.		Flying clouds.
	12	13	23	30.05	30.15	W.	Moderate.		Clear day.
	13	13	37	.33	.23	NE. S.	Brisk.		Clear—lightly cloudy.
	14	40	44	29.10	29.85	S. W.	Moderate.		Partially cloudy.
	15	27	38	30.25	30.25	NW.	Brisk.		Cloudy—clear.
	16	22	39	.40	.40	E. SW.	Moderate.		Clear—lightly cloudy.
⊗	17	32	38	29.80	29.70	W.	do.		Fog—cloudy.
	18	44	40	.70	.90	W.	Blustering.		Flying clouds—clear.
	19	22	32	.90	30.20	W.	Light.		Clear—cloudy.
	20	28	36	.95	29.95	W.	do.		Cloudy—clear.
	21	23	44	.95	.86	W. S.	do.		Clear—cloudy.
	22	31	35	.55	.55	W.	Brisk.		Flurry of snow—snow squall.
	23	26	36	.95	30.00	W.	do.		Clear day.
	24	25	49	30.04	.00	SE.	do.		Clear—cloudy.
	25	26	42	.15	.20	NW.	do.		Clear—flying clouds.
☽	26	20	38	.35	.40	W. SE.	Moderate.		Clear day.
	27	27	50	.22	.10	SW.	Brisk.		Clear day.
	28	35	44	29.90	29.90	NW.	Calm.		Cloudy—drizzle.
	29	36	42	30.00	30.16	N. E.	Moderate.		Cloudy day.
	30	34	54	.20	.16	E.	do.	0.25	Flurry of snow—drizzle.
	31	32	54	.30	.30	W. SE.	do.		Clear day.
	Mean	27.26	39.58	29.94	29.94			0.25	

		Thermometer.	Barometer.
Maximum height during the month,		54. on 30th and 31st.	30.40 on 16th & 26th.
Minimum	do. .	13. on 12th and 13th.	29.50 on 11th.
Mean	do. .	33.42	29.94

INDEX.

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS, &C.

June, 1836.		PAGE.
1. Thrashing machine,	William Laighton,	38
2. Measuring distances,	Samuel Stone,	ib.
3. Gold extracting machine,	Nathaniel Bosworth,	39
4. Coffins from cement,	D. Dayton H. Hoyt, & J. White,	ib.
5. Truss for hernia,	John L. Heintzelman,	40
6. Stove, pyrimidal,	Thomas M. Southwick,	ib.
7. Hoisting brick, &c.	Jesse Rhinehart,	ib.
8. Hulling clover, &c.	W. Braley, and J. Walker,	ib.
9. Thrashing machine,	H. Edgar, and I. W. Edgar,	41
10. Cooking stove,	Elijah Skinner,	ib.
11. Fireplace,	I. A. Bean, and E. Skinner,	ib.
12. Thrashing machine,	T. Rucker, Jr.	42
13. Platform balance	Alexander Bliss,	ib.
14. Bridges,	George Law,	ib.
15. Cheese press,	David Phelps,	43
16. Fireplaces,	Joseph Snyder,	ib.
17. Stoves,	John C. Parry,	ib.
18. Saw set,	Herrick Aiken,	44
19. Splitting leather,	Herrick Aiken,	ib.
20. Pumps, fire engines, &c.	Henry Gates,	ib.
21. Warming buildings,	Robert Rogers,	45
22. Raising water,	David W. Hurst,	ib.
23. Mortising machine,	Jonathan Page,	46
24. Oven,	Samuel Pollard,	ib.
25. Shaving staves, &c.	John Everhart,	ib.
26. Shelling and grinding corn,	G. M. Weaver,	ib.
27. Hames,	Sereno Norton,	47
28. Saddles, spring seat,	J. G. Patmer and H. and A. Beard,	ib.
29. Propelling by weights,	Elisha Turner,	ib.
30. Refrigerator,	John Waring,	ib.
31. Hoisting machine,	Barnabas Pike,	48
32. Friction wheels,	Julien Nicholet,	ib.
33. Bee house,	William Groves,	ib.
34. Shingle machine,	Samuel B. Chapman,	ib.
35. Winnowing machine,	Jeremiah Nichols,	49
36. Mortising and tenoning,	Joseph H. Darby,	ib.
37. Washing machine,	Charles Otis,	ib.
38. Auger,	William Jones,	ib.
39. Paper ruling machine,	James C. Teasdale,	ib.
40. Sausage, meat cutting.	A. and J. Keagy,	ib.
41. Undershot wheel,	Ebenezer Cochran,	50
42. Spinner, accelerating,	Leonard Norcross,	ib.
43. Stumps, removing,	Leonard Norcross,	ib.
44. Cotton, thinning,	Jordan Gatling,	ib.
45. Hulling clover seed,	John P. Ridings,	51
46. Bellows for forges, &c.	John C. Concklin,	ib.
47. Boot cramp,	Nathan Ayer,	ib.
48. Check plates, for banks, &c.	Charles C. Wright,	ib.
49. Brick machine.	T. Miles Bannister,	52
50. Steam engine piston,	B. Wright, and G. Kitchen	ib.
51. Mortise lock,	John G. Hotchkins,	ib.
52. Boiler pipes fixing,	John Goulding,	ib.
53. Skins, softening,	Eli Kendall,	ib.
54. Boilers, culinary,	Anson W. Spencer,	53
55. Mowing machine,	J. Sturdevant, and J. Holmes,	ib.
56. Cotton planting,	Jordan Gatling,	ib.
57. Smut mill,	John Card,	ib.
58. Stove,	James Atwater,	54
59. Mortar mixing,	J. Everhart, and L. Swimley,	ib.
60. Pressing brick,	William Wadsworth,	ib.

61.	Cooking stoves,	Le Grand Fairman,	55
62.	Ovens and stoves, heating,	Charles Vale,	ib.
63.	Cutting straw, &c.	J. M‘Math,	ib.
64.	Trees, felling,	James Hamilton,	ib.
65.	Shelling corn,	J. C. Dunbar, and A. Powers,	56
66.	Cooking stove,	T. D. Burrell,	ib.
67.	Napping machine,	Reuben Daniels,	ib.
68.	Rotary steam engine,	Orson Baines,	ib.
69.	Loom for figured work,	E. Meily, Jr. and J. and S. Mellinger,	57
70.	Saddles,	A. L. Vanhorn,	ib.
71.	Hulling clover, &c.	John Whitman,	ib.
72.	Rotary steam engine	Charles Hill,	ib.
73.	Ever-pointed pencils,	Ellwood Mears,	58
74.	Churns,	Isaac Wood,	ib.
75.	Mills for grain, &c.	William S. Johnson	ib.
76.	Corn planting machine,	Thomas D. Burrall,	ib.
77.	Roofs, metallic,	John Bouis,	59
78.	Flask for casting kettles, &c.	David Stewart,	ib.
	July, 1835.		
1.	Coopers' ware, making,	Isaac Hoover,	119
2.	Stove,	Ernst G. Augustine	ib.
3.	Straw cutting,	Ernst G. Augustine	120
4.	Shoes, water proof,	Ernst G. Augustine	ib.
5.	Vinegar, making,	Frederick W. Boden	ib.
6.	Combing wool,	Samuel Couillard	121
7.	Roots, cutting,	Jonathan Clark	ib.
8.	Horse power,	Thomas Mitchell	ib.
9.	Steam, accidents from, preventing,	George R. Clarke	ib.
10.	Wool, cleaning from burs, &c.	Michael N. Simpson	122
11.	Thrashing machines,	Joseph Tyler	ib.
12.	Water pumps,	Amos Miner,	123
13.	Fulling mill stocks,	E. S. Norris	ib.
14.	Locks and Latches,	Albert Bingham	ib.
15.	Piano Fortes,	Thomas Loud	ib.
16.	Mortising machine,	Israel J. Richardson	ib.
17.	Mills,	George and F. R. Baker	124
18.	Chisels,	George Payne	ib.
19.	Linseed oil, substitute for,	S. T. Todd and J. L. Peabody	ib.
20.	Saw mill,	Ernst G. Augustine	ib.
21.	Felloes, bending,	Edward Reynolds	ib.
22.	Cultivator,	Daniel Davis	125
23.	Rollers for curtains, &c.	Henry Lawson	ib.
24.	Churn	Oliver Wyman	ib.
25.	Stoves, cooking	John Moffat and Morton Taintor	ib.
26.	Potash, manufacturing	H. Hartsuff and C. French	126
27.	Mortising machine	Imla Wright,	ib.
28.	Water wheels	Isaac Powell	ib.
29.	Plough	Timothy Miller	127
30.	Weavers' reeds, heddles and harness	J. A. Wilkinson	ib.
31.	Looms	Oliver C. Burr	ib.
32.	Churn floats	Reding Ryerson	ib.
33.	Plough	Samuel Cline	ib.
34.	Washing machine	Asa W. Soule	ib.
35.	Coffins of cement	John White,	128
36.	Cloth, manufacturing	Freeman Wolcot	ib.
37.	Corn shelling	John P. Small	ib.
38.	Stove	Jordan L. Mott	ib.
39.	Corks, cutting	J. Cutler and I. Keyes	ib.
40.	Stoves	Jordan L. Mott	129
41.	Knobs and handles for stoves	Jordan L. Mott	ib.
42.	Churning	Hiram Phelps,	ib.
43.	Fireproof chests	John Scott	130
44.	Slide valves	Andrew M. Eastwick	.bi

45.	Rotary steam engines	Mason Young	ib.
46.	Tenons, cutting on spokes	William Gerrish	ib.
47.	Churn	Russel Bradley	131
48.	Stoves	D. West and Ferdinand Van Sickle	ib.
49.	Churn	William A. Henrich,	ib.
50.	Paper rags, cleaning	William Debit	ib.
51.	Height of water in boilers	Jesse Fox	132
52.	Height of water in boilers	Jesse Fox	ib.

August, 1835.

1.	India rubber, spreading, &c.	William Atkinson	194
2.	Saw set	Theodore Taylor	ib.
3.	Churn	Joseph Turner	195
4.	Corn sheller	Joseph Turner	ib.
5.	Candles, making	William Morey	ib.
6.	Cartouche box	Robert Dingee,	ib.
7.	Grass seeds, hulling	Samuel Gould, Jr.	ib.
8.	Cooking stoves	Solomon Dixon,	196
9.	Cutting and press machine	Benjamin Morris,	ib.
10.	Shoe pegs, splitting	Mark Wilder,	ib.
11.	Rotary Pump	David M. Walker	197
12.	Potash, making	Elijah Williams	ib.
13.	Ship building	Charles Olcott	ib.
14.	Washing and bleaching machine	Calvin H. Farnum	ib.
15.	Shingle sawing machine	David B. Moore	198
16.	Brick machine	George W. Gilbert	ib.
17.	Bricks for roofs, &c.	James Parker	ib.
18.	Press for cotton, &c.	E. Macomber and L. L. Macomber	199
19.	Evaporating and condensing solvents,	J. Golding and R. Brackett	ib.
20.	Stove for heating irons	John Lewis	ib.
21.	Water lime cement for roads	Joseph Robey, Jr.	200
22.	Churn	Caleb Angerine	ib.
23.	Harpoon	Dexter N. Chamberlain	ib.
24.	Wire door spring	John Codman	ib.
25.	Heat, saving, in steam boilers	Tunis V. Leroy	201
26.	Power loom	Amasa Stone	ib.
27.	Gates for canal locks	David Wilkinson	ib.
28.	Silk, unwinding and spooling	Gamaliel Gay	ib.
29.	Mowing machine	John P. Chandler	202
30.	Wheel, spiral band	Samuel S. Walley	ib.
31.	Anthracite, breaking	Jonathan S. Hubbell	ib.
32.	Grain, grinding and chopping	Pierson Cope	ib.
33.	Pocket pistol	Victor M. Wallace	203
34.	Cooking stove	Ezekiel Gore	ib.
35.	Tide power	Henry B. Fernald	ib.
36.	Saddletree	John M. Bouton	204
37.	Plummer blocks, &c.	Matthias W. Baldwin	ib.
38.	Oil of harze	C. Preswick and J. M. Fisher	ib.
39.	Composition of plaster, &c.	Julius Notch	ib.
40.	Brushes	William Steel	205
41.	Screw wrench	Solyman Merrick	ib.
42.	Vapour bath	P. P. N. D' Alvigny	ib.
43.	Sawmill saw	Levi Fisk,	206
44.	Churn	Clifton C. Stearns	ib.
45.	Pendulum level	Asahel Munger	ib.
46.	Planing machine	Fisher Stedman	ib.
47.	Chairs, making	Eli F. Benjamin,	207
48.	Rotary steam and air engine	George Cameron	ib.
49.	Hemp and flax, dressing	John Goulding,	ib.
50.	Horse power	Benjamin Wales	208
51.	Cholera medicine	Robert S. Bernard	ib.
52.	Cooking stove	Edward N. Kent	ib.
53.	Metallic roofing	Charles Bonnycastle	209
4.	Grain and flour, drying, &c.	James Lee	ib.

55. Rigging ropes	James Fales	ib.
56. Grist mill	Adna L. Norcross	ib.
57. Spinning hemp, &c.	Andrew Caldwell	ib.
58. Forcing pump	William Douglass	210
59. Stove backs and linings	Joseph Putman	ib.
60. Granaries	John Harmony	ib.
61. Cultivator and harrow	Peter Clark	ib.
62. Steam boilers	Nathan Reed	211
63. Bricks, pressing, &c.	Hunsicker and Krauss	212
64. Washing machine	David Winthrop	ib.
65. Washing machine	W. and J. Collins,	ib.
66. Hydraulic cement	Parker, Clowes, and Garfield	ib.
67. Cooking ranges	Thomas B. Smith	ib.
68. Arresting sparks	Alfred C. Jones	213
69. Turpentine, &c. distilling	Isaiah Jennings	ib.
70. Neck stocks	Thomas Goodrum	ib.
71. Mill gearing	Cleaverious R. Coleman	ib.
72. Thrashing machine	William Matthews,	214
73. Thrashing machine	John Gearhart	ib.
74. Mould-boards	William Holt,	ib.
75. Fire engine	Thomas Odiorne	ib.
76. Pump	Thomas Odiorne	215
77. Grater	Ebenezer B. Story	ib.
78. Grooving planes	James Herman	ib.

September, 1835.

1. Lever press	Jonathan Payne	251
2. Churn, and washing machine	Thomas Ling	ib.
3. Washing and fulling machine	Orrin D. Wade	252
4. Potters' clay, purifying	Adam Weber	ib.
5. Platform for rail roads	John Tustin	ib.
6. Corn shelling machine	Elijah Morse,	ib.
7. Hydraulic cement	Obadiah Parker,	253
8. Artificial stone	Obadiah Parker	ib.
9. Artificial stone	Obadiah Parker,	ib.
10. Water, application of, to mills	J. W. Dart and S. Wood	ib.
11. Gum elastic cement	Charles Goodyear	ib.
12. Steam engine	John Bennock	254
13. Scales for weighing	Jesse Marden	ib.
14. Rail road cars	Charles Davenport	255
15. Dead spindle	Henry G. Davis	ib.
16. Disengaging horses	Gotleib Shultz	ib.
17. Railway cars	Anthony Sherman	ib.
18. Corns, curing	William Davis,	256
19. Coffee mill, &c.	E. Morse and C. Putnam	ib.
20. Bedstead for invalids	N. Richardson	ib.
21. Saw set	Lewis Barmore,	ib.
22. Stamp for post offices, &c.	Benjamin Chambers	257
23. Supplying air to fires	Robert Mayo,	ib.
24. Gauging saw logs	William A. Needham,	258
25. Cooking stoves	J. Whiting and J. Mears	ib.
26. Coopers' howel and croes	Melancthon Sutton	ib.
27. Washing machine	James Lombard	ib.
28. Saw mill	Linus Yale,	259
29. Breaking sward ground	Guy Gray	ib.
30. Looms for weaving stocks	Conrad Kile	260
31. Tailors' measure	John S. Rockafellow	ib.
32. Beds, cots, &c.	W. J. Lyman and A. E. Lyman	ib.
33. Plough	P. Stahl and I. Diffenbacker	261
34. Wool and flax machine	Wm. W. Calvert	ib.
35. Printing and Dying woolens	Wm. Duncan,	ib.
36. Planting cotton machine	Robert S. Goodman,	262
37. Corn shelling	J. S. Harris	ib.
38. Boxes in hubs, setting	E. Badlam, Jr.	ib.
39. Timepieces propelled by air,	Andrew Morse, Jr.	ib.

40.	Dressing hoops	B. Kimball, A. Pevey and F. Spalding	263
41.	Cradling machine	Edward Badlam, Jr.	ib.
42.	Seed collector	D. Ashmore and J. Peck	ib.
43.	Mill stones, dressing	D. B. Napier	264
44.	Saw mill carriage	Samuel Phelps	ib.
45.	Propelling boats,	J. L. Smith	265
46.	Glue, manufacturing	Jonathan Morgan	ib.
47.	Cooking stove	Ezekiel Daball	ib.
48.	Gathering clover seed, &c.	Hiram Holt	266
49.	Turning boots, machine for	S. C. Blodgett and H. Boynton	ib.
50.	Cooking stove	P. Page	ib.
51.	Forge back	J. Knickerbacker,	ib.
52.	Boilers, alarm for	Thomas Odiorne	267
53.	Chimney and fireplace	Moses Perin	ib.
54.	Grist mill	Owen Moses	ib.
55.	Blower, spiral cone	Benjamin Brundred	ib.
56.	Washing machine	J. J. and E. C. Milliken	268
57.	Mead	Theo. T. Kimball and A. H. White	ib.
58.	Forges, &c., air supplied to	S. W. Watson and C. Robinson	ib.
59.	Finance, plan for	John Golder,	ib.
60.	Silk weaving by power loom	Gamaliel Gay	ib.
61.	Writing ink	John D. Myers	269
62.	Turning curves on rail roads	J. Stimpson,	ib.
63.	Forming rail road plates	J. Stimpson	ib.
64.	Shingles, shaving	Wm. H. Wilkinson	ib.
65.	Saw mill machinery	John Muir	270
66.	Bedstead	Perry Prettyman	ib.
67.	Mortising machine	Charles Gates	ib.

October, 1835.

1.	Double speeder	William Field	325
2.	Lamp wicks, raising	Samuel Rust	326
3.	Pelisse wadding	Stukely Turner	ib.
4.	Planing Boards, &c.	Reid R. Throckmorton	ib.
5.	Fireplaces	Ebenezer S. Greely	327
6.	Clover seed, &c. cleaning	Moses Davenport	ib.
7.	Silk worms, rearing	Gamaliel Gay	ib.
8.	Saw Mill	Uri Emmons	ib.
9.	Thrashing &c. machine	Russel Bradley	328
10.	Spring saddle	Joel Woodward	ib.
11.	Stave and shingle machine	Everhart, Pearson, Morford & Everhart	ib.
12.	Alcohol from apples	Anson Walcott	ib.
13.	Ploughs	William Walker	329
14.	Caoutchouc, cutting	William Atkinson	ib.
15.	Ropes, laying	John Goulding	ib.
16.	Hemp &c. hatcheling	John Goulding	ib.
17.	Horse power	Moses Davenport	ib.
18.	Tin Baker	Nathaniel D. Whitin	330
19.	Cooking stove	Elnathan Samson	ib.
20.	Clover seed, &c. thrashing	Asa Burgess and Herman Baldwin,	ib.
21.	Hydrostatics and Pneumatics	R. Mills, and H. B. Fernald	ib.
22.	Washing machine	John O. Geer	331
23.	Staves, cutting	George Pack	ib.
24.	Rail roads	Roswell Bourne	332
25.	Churn	Asahel Bacon	ib.
26,	Rotary steam engine	Arnold Buffum	ib.
27.	Doffer for wool cards	Stephen R. Parkhurst	ib.
28.	Grates or grate bars	Jordan L. Mott	333
29.	Roads, constructing	Thomas Earl	ib.
30.	Cast iron window sash	James S. Stoddard	ib.
31.	Canal boats	James O'Conner,	ib.
32.	Springs of carriages	Henry Pace, Sen.	ib.
33.	Lathe	James Haven	334
34.	Rail road car	George W. Cleveland	ib.
35.	Stove, or Furnace	Denison Olmsted	ib.

36.	Gimblets and Augers	Orville B. Percival	335
37.	Washing machine	Henry Ault	ib.
38.	Fire arms	Samuel Ladd	ib.
39.	Felloes, cutting	J. S. Brown and J. J. Barker	ib.
40.	Mill for coffee, &c.	David Richmond	336
41.	Felloes, cutting	W. Braley and M. L. Worthley	ib.
42.	Bridges	Richard T. L. Witty	ib.
43.	Sparks, arresting	Haut C. Wiatt	337
44.	Cooking stove	Horatio B. Wade	ib.
45.	Coal stove, anthracite	Eliphalet Nott	ib.
46.	Tanning, preparing skins for,	J. C. F. Saloman	ib.
47.	Steam boilers	J. C. F. Saloman	ib.
48.	Ploughs	Junius S. Tefft	338
49.	Washing machine	Isaac Spicer	ib.
50.	Screw for glass knobs	Orren Newton	ib.
51.	Cement for cisterns, &c.	W. N. Carson and G. Roberts	ib.
52.	Biscuit, &c. cutting	T. Havener and T. H. Havener	339
53.	Calendering cloth	Zenas Bliss	ib.
54.	Roofs, covering	Phineas Burgess	ib.
55.	Crackers, &c. cutting	William R. Nivins	340
56.	Feathers, cleaning	George Reynolds	ib.
57.	Planing boards, &c.	Ried R. Throckmorton	ib.
58.	Bricks and Tile	Benton P. Coston	ib.
59.	Surveyor's Compass	Samuel R. Miller	341
60.	Tubes and hinges	William Shaw	ib.
61.	Mortising timber	John M'Clintoc	ib.
62.	Cars, &c. propelling	Alexander M'Grew	ib.
63.	Sawing stone	Daniel Bunnel	342
64.	Sugar &c. boiling	John Steele, Jr.	ib,
65.	Stove	Philip Benedict	ib.
66.	Oven	Jacob Baldwin	ib.
67.	Boots, &c. cutting	Josiah T. Buck	ib.
68.	Horse collars	Caleb Angevine	343
69.	Moulds for sugar, &c.	Charles Duncan	ib.
70.	Power motion machine	David Russel	ib.
71.	Portable saw mill	David Russel	ib.
72.	Rail road carriage	William T. James	344
73.	Fireplace	John Chapin Howard	ib.
74.	Cotton whipper,	Lucian Osgood	ib.
75.	Cotton seed, hulling	A. Miller and T. Laws	ib.
76.	Plough coulters	Samuel A. Sperry	ib.
77.	Lock for drawers	Edward Brown	ib.
78.	Cloths, drying	Stephen R. Parkhurst,	345
79.	Planing machine	Ira McLaughlin and Hiram Hill	ib.
80.	Staves, dressing	Joseph Sweet	ib.
81.	Corn, crushing, &c.	Anderson P. H. Jordan	346
82.	Cement	Charles Clinton	ib.
83.	Horse power	Trahern, Heberling, Lukins & Heberling	ib.
84.	Ploughs	John W. Jordan	ib.
85.	Gridiron, rotary	Kellog Strong	347
86.	Cutting teeth, &c.	Andrew J. Mervin	ib.
87.	Pumps	Joseph Redelsperger	ib.
88.	Rotary pumps	C. Peters and Benjn. Deane	ib.
89.	Truss, spring	Henry Ried	348
90.	Comb, metallic	Nathaniel Bushnell	ib.
81.	Tailor's measure	Frederick A. Fairchild	349
92.	Steel yard	C. F. Dahl	ib.
93.	Stove, or fireplace	Daniel Sutherland	ib.
	November, 1836.		
1.	Prussiates, making and dying with	Felix Fossard	403
2.	Cutting straw, &c.	Henry C. Jones,	ib.
3.	Charcoal kiln	E. B. Gilbert	ib.
4.	Horse Rake	James Pudney	ib.
5.	Crackers, cutting	L. P. Clarke	404

6. Cutting straw	Ashman Hall	ib.
7. Grist mill	Philip Hauser	ib.
8. Rotary steam engine	John G. Hotchkiss	ib.
9. Smut Machine	John Tuck	405
10. Railroad and canal transportation	John Elgar	ib.
11. Canal steamboat	John Elgar	ib.
12. Balance for counters	Elias A. Hibbard	ib.
13. Tanning, extract of bark for	Otis Batchelder	406
14. Horse collars	H. C. Call	ib.
15. Screen for grain	E. P. Fitzpatrick	ib.
16. Anti-friction box	E. Fisk and J. C. Green	ib.
17. Steam engine, centrifugal	Charles J. Conway	407
18. Cisterns, &c., water proof	Levi Kidder	ib.
19. Anodyne sirop	Rezin Thompson	ib.
20. Floating dry dock	Rufus Porter	ib.
21. Smut machine	E. P. Fitzpatrick	ib.
22. Japan for leather	William Gates	408
23. Fireplace, &c.	J. Douglass	ib.
24. Truss, for hernia	V. Wilkinson	ib.
25. Hair, extracting from skins	Nahum Swett	409
26. Truss for hernia	Robert Semple	ib.
27. Propelling by screw	E. P. Fitzpatrick	ib.
28. Cheese press	W. C. Greenleaf	ib.
29. Spark catcher	G. Holbrook	410
30. Feathers, dressing	B. Smith	ib.
31. Medicine administered by steam	Benjamin Grut	ib.
32. Bedstead and mattrass	E. Cherrington	ib.
33. Sopha, &c. springs for	E. Cherrington	411
34. Rail roads	E. Johnson	ib.
35. Horse shoe machine	Henry Burden	412
36. Spring saddle	Adam Hickman	ib.
37. Floating dry dock	J. R. Campbell and I. S. Withington	ib.
38. Steam boilers	Thomas Ashcroft	ib.
39. Chilling castings	Henry Saunders	413
40. Mortising machine	J. M‘Bride	ib.
41. Turnabouts for rail roads	David Evans	414
42. Canal boat, sheet iron	L. Parmellee	ib.
43. Spring saddle	Charles Bates	ib.
44. Water wheel	Edward Newman	ib.
45. Asbestos, application of	John Scott,	ib.
46. Sheet-iron fireplace	Gilbert Richards	415
47. Cotton seed huller	John Ambler, Jr.	ib.
48. Hydrant	Sater F. Walker	ib.
49. Grist mill	Samuel Hyde	ib.
50. Saw	John Ruthven	ib.
51. Spark catcher	J. W. Waples	416
52. Cloth winding machine	J. Goulding and R. Brackett	ib.
53. Diving dress	J. R. Campbell	417
54. Kiln for grain	Thomas Crook	ib.
55. Hot air hearth	L. V. Badger and R. Walker	ib.
56. Cutting straw	John Wirt	418

A

Acacia wood, durability of, 362
African discovery expedition, new, 141 bis.
Alkalies, separating mixtures of, remarks on, by A. D. Bache, 305
American patents, with editor's remarks, 38, 119, 194, 251, 325, 403
American patents, monthly list of, 70, 142 bis., 287, 366, 437
American almanac, 1836, notice of 37
Arsenic in English sulphuric acid 435
Artesian wells, spouting fountains, and springs, Arago on 364
———————, temperature of the earth as shown by that of the waters of, 286
Ashes in different parts of wood, proportion of 282
———, preparing and leaching, Williams' *patent*, 272
Astronomy, a treatise on, by Sir John Herschel, notice of, 400

Aurora borealis as a prognostic of weather, 134 bis.
——————— of Oct. 18, 1835, 365
———————at Toronto 433
Avery's rotary steam engine, remarks, &c. on, 172

B

Bache, Prof. A. D., on meteors in 1834, 33
——————— notice on rain, 106
——————— non-conducting power of ice, discovery of, 182
——————— on Dr. Thomson's mode of separating alkalies, 305
Balances, lever and spring, by C. T. Coathupe, 280
Barometer, height of, near the top of Chimborazo 434
Beaches, on the motions of shingle, by H. R. Palmer, C. E. 135 bis.
Beet, cultivation of, in France, 366
—— root sugar 436
Berlin iron ornaments, 286
Bibliographical Notices.
The Book of Science—Chemistry, 36
The American Almanac for 1836, 37
The Naval Magazine, 316
Herschel's Astronomy, with Walker's Questions, 400
Blast, use of the hot air, by A. Guenyveau, 62, 135, 354
Bleachers, hints to 436
Boiling liquids in vacuo, Steele's *patent,* 353
Boilers of steamboats, promoting safety in, 372
Booth, J. C., review of Mitscherlich's Compendium of Chemistry, 393
Bricks and mortar, statute of 437
British projects for 1835 436
Bronze, sheathing of ships with, 362
———, varieties of, ib.
Bronzing medals, liquid for, 427

C

Calcareous cements, by James Frost, C. E. 234
Canadian twin steamboat 437
Canal, Liverpool and Manchester new, 138 bis.
——, report on Sandy and Beaver, by E. H. Gill, C. E. 23
Canals and rail-roads, apparatus for transportation on, Elgar's *patent,* 418
Carriage wheels, best form of, 67
Cast iron, action of salt water on 437
——— Piano 436
Casts from models, application of tannate of gelatine to taking, 361
Celestial phenomena, from February to July, 1836, 72, 144 bis., 288, 368, 440
Cements, experiments on hydraulic 436
Chemical analysis, indirect method of, remarks on, by A. D. Bache, 305
Chemistry, review of Mitscherlich's compendium of, by J. C. Booth, 393
Chimborazo, height of barometer near the top of 434
Chronometers, prize, 365
——————— Harrison's 436
Coaches, desideratum in the construction of stage 436
Coal mines in Illinois, notice of, 375
Column, erection of the York 437
Combustion, spontaneous, by M. Scanlan, 424
Comets shine by reflected light, 365
Conductors, tidal motions of, by J. W. Draper, M. D. 27
Condensers, gas, 22, 92
Cornelius' R. substitute for waste cock, 22
Cotton and other seeds, hulling, Ambler's *patent,* 421
Curves, short, on rail-roads, turning, Stimpson's *patent,* 278

D

Density of metals affected by wire drawing, &c. 426
Distilling spirits of turpentine, Jennings' *patent,* 275
Doffer for wool cards, Parkhurst's *patent,* 351
Door lock, report on P. Laibacker's 118
Draper, J. W. on electrical conductors 27
————J. W., on endosmosis 177

Drainage, proportion of, to fall of rain . . . 427
Dry rot, preserving wood from . . . 282
———, some remarks on, by C. Waterton, . . . 360
Dyers, hints to . . . 436

E

Earth, temperature of, as shown by the waters of the Artesian wells 286
Eclipse of May, 1836, solar, by S. C. Walker, . . 246
Editor's remarks on patents, from June to Nov., 1835, 38, 119, 194, 251, 325, 403
Electricity, elementary laws of, by W. S. Harris . . 68, 143
———, the velocity of, by Charles Wheatstone . . 144
———, experimental researches in, by M. Faraday, . . 282, 362
Endosmosis, experiments on, by J. W. Draper, M. D. . . 177
Engineering, civil . . . 23, 101, 135 bis., 174, 427
Engraving on copper in relief, . . . 426
Espy's essays on meteorology, . . . 240, 309
——— remarks on second report of the committeee on meteorology 391
Explosion of the boiler of the steamboat William Gibbons, Ewbank on . 298
Explosions of steamboat boilers, on Mr. Perkins' suggestions with regard to 369
——————— report on 1, 73, 145, 217, 289

F

Faraday's researches on electricity, . . . 282, 362
Featherstonhaugh's report on geology, review of . . 109, 184
Finance, improvement in, Golder's *patent*, . . . 277
Fire alarm, report on Seymour & Whipple's, . . 117
Flasks for moulding tea-kettles, Stewart's *patent*, . . 60
Flint and chalcedony, compound minerals, . . . 286
Franklin's hypothesis of rain, notice of, by Prof. A. D. Bache, . 106
Frost, J., civil engineer, on calcareous cements, . . 234
FRANKLIN INSTITUTE.
    Report on the explosions of steam-boilers, . . 1, 73, 145, 217, 289
    Monthly conversation meeting, . . . 117, 317, 400
    Annual meeting, minutes of, ... 190
    Twelfth annual report, ... 191
    Minutes of the Board of Managers, . . . 248
    Report of the committee of premiums and exhibitions, . 318
    Quarterly meeting. 401
    Report of the Board of Managers, . . . ib.
Committee on Science and the Arts.
    Report on Seymour & Whipple's fire alarm, . 117
    ——— Philip Laibacker's door lock, . . 118
    ——— Joseph Snyder's parlour grate, . . ib.
    ——— A. C. Jones' spark arrester, . . 249
    ——— L. V. Badger's hot air forge . . . 250
    ——— second annual, of the transactions of the committee, . 193

G

Gas, cooking by . . . . 141 bis.
Gas condensers, query on 22
———, reply to query on, . . . 92
Gas, expansion of liquified . . . 434
Geology, review of Mr. Featherstonhaugh's report on, . 109, 184
Gibraltar, current through the straits of . . . 142 bis.
Gill, E. H. report on Sandy and Beaver canal, . . 23
Glass, composition and specific gravity of . . . 66
Grate for parlours, report on J. Snyder's, . . 118
Gray sulphur springs, analysis of the waters of the . 435
Greenwich rail-way project . . . 437
———Time ball at . . . 432

H

Hail, theory of, by J. P. Espy, . : . 240, 309
Heat process, Rutter's, . . . 68
——, repulsive power of, by Rev. B. Powell, . . 133 bis.
Hedgehog, fact relating to . . . 286
Heights, unpleasant effect upon the system at great . 365
Herschel's treatise on astronomy, notice of . . . 400

Hot air blast, on the use of the, by A. Guenyveau, . . 62, 135, 354
——— forge, report on L. V. Badger's, . . 250
Howard's quicksilver engine, ... 142 bis.
Hunter's stone planing machine, . . . 139
Hydrants, substitute for a waste cock to, by R. Cornelius, . 22

I

Ice, non-conducting power of, by Prof. A. D. Bache, . . 182
Illinois, coal mines in 375
India rubber, spreading on cloth, Atkinson's *patent*, . . 270
Insects destroyed by chamomile, . . . 366
Iron, smelting, effects of velocity of blast in . . 281
—— ornaments, Berlin, ... 286

J

Jefferson (President) letter on rights of patentees, . . 95
Jones, A. C. spark arrester, described . . 100
———————————— report on . . . 249

K

Kiln drying flour, &c., Lee's *patent*, . . . 274
Knighthood, mechanical . . . . 141 bis.

L

Lamp, new spirit 361
Laws of electricity, elementary, . . . 68, 143
Law case, patent, Stanly *v.* Hewit, . . . 165
Lea, I. on the Naïades, ... 184
Lever and spring balances, by C. T. Coathupe, . . 280
Liquids, boiling under a vacuum, Steele's *patent*, . . 353
Liverpool and Manchester new canal, . . 138 bis.
Locomotive engine, magnetic 365

M

Magnetic locomotive engine, . . . 365
Marbles, preserving, by wax, . . . 436
Mechanical knighthood, ... 141 bis.
Mechanic, progress of a French, . . . 286
Medals, casts of, in tannate of gelatin . . . 361
———, liquid for bronzing, . . . 427
Metals, effect of drawing, rolling, annealing, &c. . . 361
———, table of the properties, &c. of, by F. Peale, . . 375
———, density of, affected by wire drawing, . . . 426
Meteors of 1833, on the recurrence of the, by Prof. A. D. Bache, . 33
Meteorolal. observa. from Oct.1835, to March, 1836, 72, 144 bis., 216, 288, 368, 440
Meteorology, essays on, by J. P. Espy, . . . 240, 309
————— report of committee on . . . 386
—————————————— remarks on, by J. P. Espy, . 391
Mineral pitch lake of Trinidad . . . 437
———waters of Nevis . . . 436
Mitscherlich's Compendium of Chemistry, review of, by J. C. Booth, 393
Mortality in Europe, ... 286
Motions of conductors, tidal, by J. W. Draper, . . 27
Mountains, colour of sky as seen from high . . 434

N

Naïades, I. Lea on the 184
Naval Magazine, notice of . . . 316
Nevis, on the mineral waters of . . . 435

O

Ornaments, Berlin iron . . . 286
Organ, Birmingham 365
Oxygen in air contained in snow, . . . 286
———, tellurium and its compounds with . . . 285

P

Patents, list of American . . 70, 142 bis., 287, 366, 437
———, American, list of, with remarks, . 38, 119, 194, 251, 325, 403
Patentees, the rights of 94
Patent law case, Stanly *v.* Hewit, . . . 165
Patents, on surrendering and renewing, by the editor, . 239

Peale, F., table of properties of metals, 375
Penholders, whalebone 437
Pianos, cast-iron 436
Pinkus' pneumatic railway, 21
Plants, preservation of, in brine, 366
Platinum points, substitutes for 427
Plummer blocks, &c. for steam engines, Baldwin's *patent* 273
Popular Science, new Journal of ib.
Potassa and soda, mode of ascertaining their proportions when mixed, 305
Potash, making, Williams' *patent*, 272
Power, obtaining, for propelling cars, &c., M'Grew's *patent*, 352
Pump for feeding steam engine boilers, by C. Potts, C. E. 302

Q

Quadrant, the 286
Quicksilver engine, Howard's, 142 bis.

R

Rails, authorship of mode of setting, 140 bis.
Railway, Greenwich, project 437
———, pneumatic 21
———, undulating 141 bis.
Rail-road from the Ohio to South Carolina, 101
——— West Philadelphia, 174
——— turning short curves on, Stimpson's *patent*, 278
——— from Hartford to Canadian line, 428
——— apparatus for transportation on canals and, Elgar's *patent*, 418
Rain, Franklin's hypothesis, notice of, by Prof. A. D. Bache, 106
—— at different elevations, 286
——, proportion of drainage to fall of 427
Rotary steam engine, Avery's remarks, &c. on 172
Rotary steam engine, Foster & Avery's *patent*, 279
Rutter's heat process, 68

S

Saddles, riding, Van Horn's *patent*, 59
Salt-water, action of, on cast-iron 437
Sandy and Beaver canal, report on, by E. H. Gill, C. E. 23
Sausage meat, cutting, &c., Keagy's *patent*, 61
Schuylkill navigation co., business of the 431
Seeds, hulling cotton and other, Ambler's *patent*, 421
Shingle beaches, on the motions of, by H. R. Palmer, C. E. 135 bis.
Silk worms, rearing of, Gay's *patent*, 349
Sky, colour of, at considerable heights, ib.
——— as seen from high mountains 434
Smelting iron, effect of velocity in blast for 281
Soda and potash, mode of ascertaining their proportions when mixed, 305
Spark arrester, A. C. Jones', 100
———, report on A. C. Jones', 249
Specific gravity, and composition of glass, 66
Spontaneous combustion, by M. Scanlan, 424
Springs, Artesian wells, and spouting fountains, Arago on 364
Statute of brick and mortar 437
Steamboat Lexington 436
——— Canadian twin 437
Steam engine, experiments for safety of 141 bis.
——— boilers, explosions of 1, 73, 145, 217, 289
——— boat Wm. Gibbons, explosion of the boiler of 298
——— engine, Avery's rotary 172
——— engine boilers, pump for feeding, by C. Potts, C. E. 302
——— boat boilers, promoting safety in 372
———, on Mr. Perkins' suggestions regarding the explosions of 369
——— carriage, Hancock's 141 bis.
Steam carriages, Maudsley & Field's, ib.
——— power, economy of, by F. Burr, 422
Stone planing machine, Hunter's 139

Stove, improved, Mott's *patent*, 133
——, combined, Mott's *patent*, 134
——, rotary, Stanly's, decision of U. S. court, 165
Sugar from plants of the temperate zone, 171
Sugar, beet root 436
——, preparation of, from starch, 427
Sulphuric acid, arsenic in English 435
Sulphuric springs, analysis of the waters of the Gray 435
SPECIFICATIONS OF AMERICAN PATENTS.
  Riding saddles—Van Horn's, 59
  Flasks for moulding iron tea kettles, &c.—David Stewart's, 60
  Cutting sausage meat, and stuffing sausages—Abraham and John Keagy's, 61
  Washing and churning machine—Charles Otis', 62
  Slide valves for steam engines—A. M. Eastwick's, 132
  Improved stove—J. L. Mott's, 133
  ———— combined stove—J. L. Mott's, 134
  Spreading India rubber upon cloth—Wm. Atkinson's, 270
  Preparing and leaching ashes, and making potash—Elijah Williams', 272
  Plummer blocks and slides—Baldwin's, 273
  Destroying weevils in grain—Lee's, 274
  Distilling spirits of turpentine—Jennings', 275
  Improvement in public finance—Golder's, 277
  Turning short curves upon rail-roads—Stimpson's, 278
  Rotary steam engine—Foster and Avery's, 279
  Rearing of silk worms—Gamaliel Gay's, 349
  Doffer for wool carding machines—Parkhurst's, 351
  Propelling cars, boats, &c.—Alexander M'Grew's, 352
  Apparatus for boiling liquids—Steele's, 353
  Apparatus for transportation on canals and rail-roads—Elgar's, 418
  Apparatus for raising vessels—Porter's, 420
  Machine for hulling cotton, and other seeds—Ambler's, 421

T

Tannate of gelatin, application of, to taking casts from medals, 361
Tellurium, and its compounds with oxygen, 285
Thames Tunnel 429
Tidal motion of conductors, by J. W. Draper, M. D. 27
Tide and wind, registering the variations of 434
Tide observations in the United States, notice of, 108
Time Ball at Greenwich 432
Trinidad, mineral pitch Lake of 437
Turpentine, distilling, Jennings' *patent*, 275

U V

Undulating railway, 141 bis.
Vapour cave at Pyrmont, 366
Valves, slide, for steam engines, Eastwick's *patent*, 132
Velocity, effect of, in blast for furnaces, 281
Vessels, apparatus for raising, Porter's *patent*, 420

W

Walker, S. C. on solar eclipse of May, 1836, 246
Washing and churning machine, Otis' *patent*, 62
Water, quantity supplied by London companies, 142
Waste cock, substitute for, to hydrants, by R. Cornelius, 22
Water proof fabric, 365
Wax, preserving marble by 436
Weevils, &c., in grain, destroying, Lee's *patent*, 274
West Philadelphia rail-road, report on the 174
Whalebone pen holders 437
Wheels, carriage, best form of, 67
Wind, register the variations of tide and 434
Wood, preserving, from dry rot, 282
——, proportion of ashes in different parts of ib.
Wool cards, doffer for, Parkhurst's *patent*, 351
York column, erection of the 437

T
1
F8
v.21
~~Physical &~~
~~Applied Sci~~
~~[illegible]~~

Engineering

Franklin Institute,
Philadelphia
Journal

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

ENGIN STORAGE